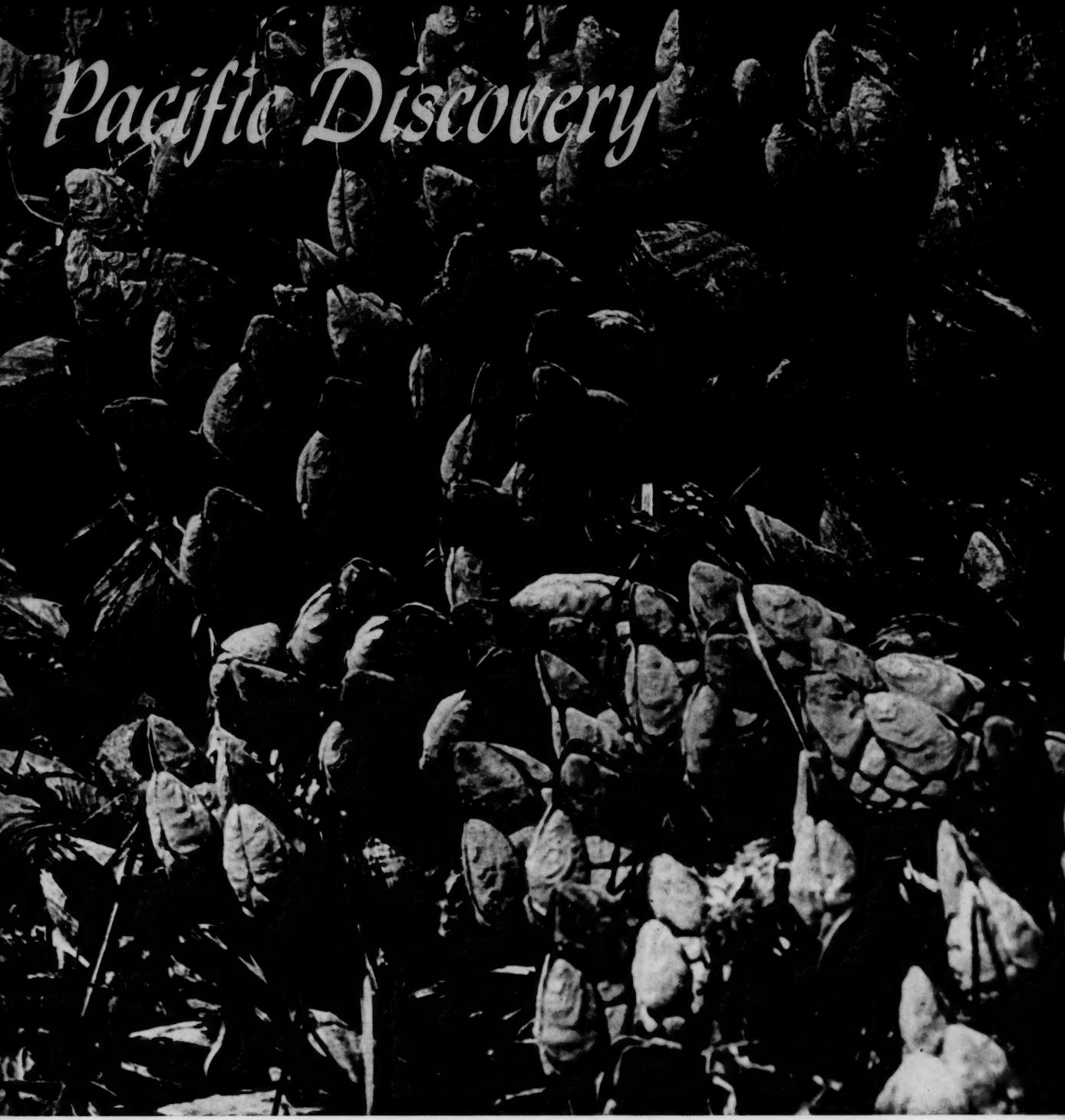


# Pacific Discovery



PUBLISHED BI-MONTHLY BY THE CALIFORNIA ACADEMY OF SCIENCES

IN THIS ISSUE: Lloyd Glenn Ingles

M. Woodbridge Williams • Borys Malkin

Victor B. Scheffer

VOLUME III • NUMBER 5

September-October 1950

FIFTY CENTS

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

# THE CALIFORNIA ACADEMY OF SCIENCES

SAN FRANCISCO

## BOARD OF TRUSTEES

J. W. MAILLIARD, JR. . . . . President CHARLES PAGE . . . . . Vice-President  
EUGENE D. BENNETT . . . ALLEN L. CHICKERING, JR. . . BRUCE CORNWALL  
MRS. JOSEPH C. FENNELLY . . . EDWARD E. HILLS . . . DANIEL E. KOSHLAND  
LAWRENCE W. LANE . . NORMAN B. LIVERMORE . . DECKER G. McALLISTER  
T. S. PETERSEN . . MRS. HENRY POTTER RUSSELL  
BRAYTON WILBUR . . DEAN WITTER

*The President of the Academy, Ex Officio . . The Treasurer of the Academy, Ex Officio  
JOHN H. ELDRIDGE . . Secretary to the Board*

## OFFICERS OF THE ACADEMY

FRANCIS P. FARQUHAR . . . . President J. WYATT DURHAM . . Recording Secretary  
E. B. BABCOCK . . . . First Vice-President HAROLD P. CHAMPLAIN . . . . Treasurer  
GEORGE S. MYERS . . . . Second Vice-President CHARLES H. DANFORTH . . . . Librarian  
E. O. ESSIG . . . . Corresponding Secretary ROBERT C. MILLER . . . . Director  
*The officers named above constitute the COUNCIL of the Academy*

## SCIENTIFIC STAFF

ROBERT C. MILLER, Ph.D., Director  
TOSHIO ASAEDA . . . . Assistant Preparator of Exhibits ELIZABETH MCCLINTOCK, M.A. . . Assistant Curator of Botany  
ROBERT P. DEMPSTER, M.S. . Aquatic Biologist ROBERT T. ORR, Ph.D. . Curator of Ornithology and Mammalogy  
ALICE EASTWOOD . Emeritus Curator of Botany MARY L. PERRY, B.A. . . Research Assistant in Mammalogy  
W. I. FOLLETT, J.D. . Curator of Ichthyology THOMAS C. GROODY, M.S. . Research Assistant in Aquatic Biology WILLIAM B. PITTS . . Honorary Curator of Gem Minerals  
G. DALLAS HANNA, Ph.D. . . Curator of Paleontology MAURICE R. RAKOWICZ . . Junior Aquatic Biologist  
VELMA HARRIS . . . . Assistant Preparator of Exhibits EDWARD S. ROSS, Ph.D. . . . Curator of Entomology  
EARL S. HERALD, Ph.D. . . . Curator of Aquatic Biology VERONICA J. SEXTON . . Executive Librarian  
LEO G. HERTLEIN, Ph.D. . Associate Curator of Paleontology JOSEPH R. SLEVIN . . Curator of Herpetology  
JOHN THOMAS HOWELL, M.A. . . Curator of Botany W. BARCLAY STEPHENS, M.D. . . Honorary Curator of Horology  
EDWARD L. KESSEL, Ph.D. . Associate Curator of Entomology CECIL TOSE . . . Preparator of Exhibits  
HUGH B. LEECH, M.S. . Associate Curator of Entomology EDWIN C. VAN DYKE, M.D. . Emeritus Curator of Entomology  
M. VONSEN . Honorary Curator of Mineralogy

## RESEARCH ASSOCIATES

MR. C. C. CHURCH . PROFESSOR E. O. ESSIG . PROFESSOR G. F. FERRIS  
DR. J. LINSLEY GRESSITT . THE REVEREND EDWARD S. GUEDET . DR. THOMAS H. KEARNEY  
DR. EARLE G. LINSLEY . DR. E. GORTON LINSLEY . MR. ANATOLE S. LOUKASHKIN  
MR. BORYS MALKIN . MR. LEWIS S. ROSE . MR. LAWRENCE W. SAYLOR  
MR. ALLYN G. SMITH . MR. A. M. STRONG . DR. R. L. USINGER  
DR. J. DAN WEBSTER . DR. F. X. WILLIAMS

Founded in 1853

## A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

Editor and Art Director: DON GREAME KELLEY • Managing Editor: ROBERT C. MILLER

Associate Editors: WILBERT M. CHAPMAN (*University of Washington*)JOHN L. KASK (*Food and Agriculture Organization, UN*) • A. STARKER LEOPOLD (*University of California*)ROBERT T. ORR (*California Academy of Sciences*) • EDWARD S. ROSS (*California Academy of Sciences*)IRA L. WIGGINS (*Stanford University*)

## In This Issue

*Goose Barnacles—"They Stand on Their Heads"—are related to crabs and lobsters, not to the mussels they resemble and are commonly found living with at the tide line. For the strange life story of barnacles, see pages 14 to 17.*

Photo by M. WOODBRIDGE WILLIAMS . . Cover  
EDITORIAL:

*Mythology of the American Automobile* . . 3  
FROM THE READER . . . . . 5

*Night Shift in a Sierra Meadow.*

LLOYD GLENN INGLES . . . . . 6

*They Stand on Their Heads.*

M. WOODBRIDGE WILLIAMS . . . . . 14

ROADS TO DISCOVERY:

*Passage to São Tomé.* BORYS MALKIN . . 18

*Probing the Life Secrets of the*

*Alaska Fur Seal.* VICTOR B. SCHEFFER . . 23

REVIEWS . . . . . 30

## Pre-Discovery

When our next issue is on the press, there will be an expedition of the California Academy of Sciences en route via Grace Line to Valparaiso. The Academy's curator of insects, Dr. Edward S. Ross, and his wife, Wilda S. Ross, who has contributed to knowledge of the ants, together with Professor A. E. Michelbacher of the University of California Department of Entomology, and Mrs. Michelbacher, will spend at least six months collecting in Chile, Peru, and possibly Argentina and Brazil. They will drive their own truck, camping out a good deal of the time. Dr. Ross has promised periodic field reports to continue our series "Roads to Discovery." Meantime we shall present the first part of a full-length geographical article, "Chile: Nation With the Long Reach," by C. Langdon White, professor of geography in Stanford University. This will by no means be merely introduction to our associate editor's prospective series, but will be on a par with Dr. White's notable contribution to our May-June 1949 issue, "Out of This World—The Peruvian Sierra: Its Lands and Peoples." Dr. White is a leading authority on the human geography of the Andean regions.

## Discovering PD's Authors

"In the writing of a book on mammals, problems must be solved which are very different from those that confront the author of a bird book. One problem is that most mammals are nocturnal and, although they may be much commoner than any species of bird, they are rarely seen." In the preface to his *Mammals of California* (Stanford, 1947), Lloyd Glenn Ingles might, but for modesty, have continued, ". . . except by expert animal photographers armed with flash bulbs, jack lights, and other paraphernalia of after-dark camera work." His photos in "Night Shift in a Sierra Meadow" and in his book prove him expert; the texts that go with them, in both article and book, are the work of a thorough field naturalist. Professor of zoölogy in Fresno State College, Dr. Ingles spent this summer in the northern Sierra as director of the Audubon Camp at Norden. He is known among fellow zoölogists for his studies of the mountain pocket gopher.

M. Woodbridge ("Seven Seas") Williams is now a familiar PD author, with his stories and pictures of animals that live at the edge of the Pacific. "They Stand on Their Heads" might be called a tale in the "barnacular," accompanying a photographic series, of great scientific interest, that shows through a microscope why barnacles are what they are and not what they seem to be. Woody, who lives at Inverness on Tomales Bay, north of the Golden Gate, was formerly associated with the Scripps Institution of Oceanography, and with the California Academy of Sciences

Forcibly ejecting Borys Malkin from their Guinea Gulf island, putting his "Passage to São Tome" into sudden reverse, blundering Portuguese colonial officials deprived PD readers of illustrations for another of the Academy research associate's Africa reports in "Roads to Discovery." Back on our West Coast after two years on Africa's, Borys wrote the boys from Oxford, who did succeed in getting photographs once they were allowed to land on S. Tome, in the hope of using some of their pix, but communications somehow failed. Of three or four Borys took, only one was good for a half-tone. Our regret is the greater because the Guinea Gulf islands are far off the tourist track and pictures of them rare.

Communications from Victor B. Scheffer come either from the Branch of Wildlife Research of the U. S. Fish and Wildlife Service in Seattle, or from St. Paul Island in the Pribilofs, where Dr. Scheffer spends the better part of his time "Probing the Life Secrets of the Alaska Fur Seal." PD readers will remember his article on "Dolphins: Little Known Mammals of the Pacific" in our July-August 1949 issue. He is of a devoted, highly esteemed band of American public servants whose zealous and unselfish work in science has, in the continuity of generations, brought respect and honor to certain Federal Government agencies—besides Dr. Scheffer's Service, formerly the Biological Survey, one should name among others the Smithsonian Institution and the National Museum, the Coast and Geodetic Survey, the Bureau of Standards, the Naval Observatory. (Credit for photos should be given to the U. S. Fish and Wildlife Service as well as to the author-photographer.)

D.G.K.

*Pacific Discovery* is published bi-monthly at the Gillick Press by the California Academy of Sciences. Publication office: 2057 Center Street, Berkeley 4, California. Editorial and Advertising offices: Golden Gate Park, San Francisco 18,

Copyright 1949, by the California Academy of Sciences.

California. Subscriptions: \$3 per year. Single copies: 50c. Members of the Academy subscribe through their dues. Entered as second-class matter February 17, 1948 at the post office at Berkeley 4, California, under the act of August 24, 1912.

## Should *your* heirs face *these* hazards?

An estate plan that has not been kept up-to-date! Appointment of an inexperienced Executor! Each of these "errors" could prove costly for the very persons an estate is intended to protect.

Neither hazard is necessary!

Avoid the first by reviewing your estate plan with one of our Trust Officers. Bring it into line with today's best fiduciary procedure. Then, have an attorney draw up your papers.

Assure competent management by appointing this Bank to administer your estate. Assure your heirs the sympathetic, protective attention of our staff of experienced estate managers.

*Head Office: 400 CALIFORNIA STREET  
Mission Branch: 16TH & JULIAN AVE.*

# THE BANK OF CALIFORNIA

NATIONAL ASSOCIATION  
*Incorporated in 1864*

Member Federal Deposit Insurance Corporation

SAN FRANCISCO  
PORTLAND  
SEATTLE  
TACOMA

## EDITORIAL

### Mythology of the American Automobile

NOTHING ELSE SO TYPIFIES American industrial civilization, in our own minds and in the minds of the world, as the American automobile. It has almost become a symbol of our way of life. The family that doesn't own one is regarded with sympathy by the neighbors, and a man who doesn't want one is likely to be vaguely suspected of psychopathic tendencies. Even a college boy climbs into his jalopy to go three blocks to a nine o'clock class, then spends more time hunting a parking place than it would have taken him to walk.

Visitors from abroad are able to take most of our so-called achievements in stride. They have been prepared in advance for skyscrapers, electric dishwashers and television. The airplane is already commonplace throughout the world—indeed, the visitors are most likely to have arrived in a four-motored plane with pressurized cabin, comfortable sleeping accommodations and a cocktail lounge. They will show a certain amount of surprise at the vastness of some of our engineering projects—Hoover Dam, the Grand Coulee Dam, the bridges across San Francisco Bay and the Golden Gate; all of these are more impressive than they expected. But the thing that leaves them open mouthed with amazement, the thing that, on returning home, they will talk about for years to come—incidentally stretching the credulity of their listeners—is the abundance of our automobiles.

To you and me it is highly exasperating to inch along a street or highway among cars lined up two feet apart for a distance of several miles—something that occurs with increasing frequency in every metropolitan area in the United States and in some of them occurs regularly every day of the week. But to a visitor from a foreign land such an experience is an exciting, almost unbelievable adventure. Automobiles, on a wide thoroughfare, lined up solidly as far as you can see! The visitor can hardly believe the testimony of his own eyes.

We in the United States have more automobiles than there are in all the rest of the world. In California alone we have 4,000,000 of them, more than one to every three inhabitants, man, woman and child. It has been stated that, if all the automobiles in California were lined up bumper to bumper, they would completely fill a six-lane highway reaching from San Francisco to New York; and anyone who tries to drive across the Bay Bridge at a peak hour is likely to be pretty sure the experiment is being tried.

As a passing thought, we might inquire whether there are not already more automobiles than there are people competent to drive them; and further, whether we are not being slightly ridiculous to

build a contraption that can travel 80 or 90 miles an hour, pass laws to restrict its speed to 50 or 60 on the highway and 15 to 25 in the city, then produce it in such quantity it gets in its own way and can't travel as fast as a man can walk. These inquiries, however, represent only a minor degree of heterodoxy, and fade into insignificance compared with the blasphemies we are about to utter.

Since the automobile is regarded, both by ourselves and others, as a kind of symbol of American culture—a shining chariot into which the American leaps and hastens off wherever he wants to go, whether on business or pleasure—it would be reasonable to suppose that this popular vehicle would be well designed, carefully constructed, and thoughtfully adapted to the purpose it is intended to serve. That is one of the great American myths. It is the thesis of this editorial that the contemporary automobile is badly planned, poorly made, excessively decorated, needlessly expensive, and inordinately ugly; that it violates the ordinary standards of good engineering and good taste; in short, that it represents a low ebb in American industrial design.

The 1950 automobile is a less satisfactory product of its time and place than the automobile of half a century ago, and for this significant reason: the inventors and builders of the horseless carriage of 1900 were doing the best they knew how, whereas the automobile designers and manufacturers of today are not doing anywhere nearly as well as they know how. This is not to say that they are lazy, incompetent, or intentionally venal, but that they are working toward a wrong objective. They are designing cars for the showroom floor instead of for the highway; and they are designing them to what they believe to be the public taste instead of to what they know to be the principles of good design.

A few months back we attended a showing of 1950 cars in the company of an artist friend who has had many years' experience both as a professional designer and teacher of design. We paused in front of one of the more flamboyant models, and pointed out that it had been styled by a well-known industrial designer. Our friend looked at it in pained bewilderment, and exclaimed, "Why, he's a competent man—he *knows better* than that!"

The result of this kind of discrepancy between knowing and doing, the reasons for which we shall further discuss below, is that no contemporary automobile has achieved genuine beauty, few are even passably good looking, and all reflect a tendency to substitute an excess of chromium plate for refinement of contour and subtlety of line. As

one drives down the highway and views the cars coming in the opposite direction, with their infinite variety of grotesque radiator patterns vaguely approximating the artistic level of doodlings on a telephone pad, he gains a composite picture of glittering ugliness—as of a homely dowager seeking to conceal the bitter truth beneath an overload of cosmetics and costume jewelry.

This excess of metallic luster is not only tawdry and in poor taste, but downright dangerous, because, in one place or another on the car and at different times of day, it is bound to reflect the sun into the eyes of the driver, or of other drivers. On a recent tour of the Southwest we parked one day next to a large car of expensive make which had the shining metal of its instrument panel covered with green paper pasted on with Scotch tape. Here was a story without words. In order to obtain the real or fancied mechanical advantages of a luxury car, this purchaser had to pay for a lot of needless decoration that he not only didn't want but, in the interest of safety and personal comfort, had to improvise some way of covering up.

To take another specific example, let us consider the fender. "Fender" is defined in the Century Dictionary as "that which fends, guards, or wards off." We would redefine this to read, "that which folds up, collapses, or comes off on contact with any solid object." Time was when a fender was called a mudguard, and served that purpose. In the event of any mishap, it could be replaced for around \$6.75. Today a front fender comprises about one-fifth of the body of a car, contains a headlight and parking light and, if it has to be replaced, costs as much as a vacation in the Rockies. The line of the front fender quite commonly runs across the front door, which thus becomes a part of it, and in extreme cases extends across both front and back doors until it meets the rear fender. We challenge the automotive industry to offer any sound reason, either practical or aesthetic, for this extraordinary hypertrophy of the fender. In fact, to our way of thinking, if there is anything intrinsically more ridiculous than a fur-lined bathtub or glass pants, it is a fender with doors.

The magnificence of the modern fender is, moreover, largely wasted on the owner, who can only admire it by getting out of the vehicle. We find it possible to glimpse a few inches of our left fender from the driver's seat, but have not been able to see our right fender since around 1932; and if somebody were surreptitiously to remove it, we might not miss it till the next time we washed the car.

We promised a few paragraphs back to explain why, as we think, competent automobile designers are not giving the public their best designs. It is because they feel that the public is not ready for

them, or that the public does not appreciate good design. This viewpoint in the first place underestimates the intelligence and native good sense of the average American, and in the second place it leads the designers, manufacturers and buyers into a vicious circle. Automobiles are designed according to what the manufacturers think the public wants, and then the public is educated, through a high-powered advertising campaign, to want what the manufacturers have provided.

Nothing can better illustrate this impasse than the current campaign to compare the automobile to an airplane, or—worse yet—a rocket. Most of the manufacturers who are not frankly trying to imitate the fuselage of an airplane are vying with each other in claiming for their product various aeronautical properties. All of this is pure, unadulterated hooey. Any automobile that really behaved like an airplane in any significant degree would not be allowed on the highway.

Let us explore this matter for a moment. Suppose—as might happen in a bad dream—your automobile suddenly began to develop the properties of an airplane. In order to start, you would need 500 yards of unobstructed highway, something the average motorist seldom sees. You couldn't operate in a fog, and couldn't start in a cross wind. You would have to warm up your motor for ten minutes, listening anxiously for any signs of trouble. Then you would throw away your cigarette, fasten your safety belt, gun your motor to its utmost capacity and roar down the highway with a noise like firecrackers at a Chinese New Year's celebration. If you got into or near a thunderstorm you would be shaken up worse than if you were driving a jeep down a corduroy road. At the end of the journey you would find just as much trouble stopping as starting, would need just as much room, and—if you were not both expert and careful—would bounce a few times with squealing tires. Is this what the advertisements mean? We doubt it.

As a final *reductio ad absurdum* of this airplane complex we have lately seen several cars with a toy propeller attached to the radiator (not standard equipment, we hope!). Oddly enough, this remarkable gadget is invisible to the driver—having gone to the trouble to install it, he can't even watch it go round. To people who like this sort of thing, we respectfully suggest that it is both cheaper and more fun to get a pinwheel on a stick and run up and down the sidewalk in front of the house.

We do not deprecate the airplane. On the contrary, we admire it in its proper sphere—which is the atmosphere. But let's get down to earth with the automobile.

R.C.M.

# FROM THE READER

## Academic Freedom

EDITOR, *Pacific Discovery*  
SIR:

The thesis of Dr. Miller's editorial on academic freedom in the May-June PD, that "the only people in a position to decide what should be taught are those who are doing the teaching," contains an undeniable challenge to thought. Although its application to the field of science has been convincingly demonstrated, the question whether it will withstand objection in matters of morals or politics seems somewhat tougher.

In this connection, Dr. Miller's example of the stone-age teacher instructing his students to pat a sabre-toothed tiger fearlessly on the head (whereby it would be demonstrated that the teacher "would clearly be incompetent and ought to be fired," whether or not, one gathers, his professional colleagues were sympathetic to his anti-social error) suggests analogies in modern times, on which certain decisions of constitutional law may perhaps throw a light transcending legalism.

So, it has been determined by the United States Supreme Court that, despite civil liberties as guaranteed by our Constitution, representatives of the public, established as a board of regents of a state university, may justifiably conclude, even in time of peace, that instruction in military science shall be a compulsory element of the university curriculum. *Hamilton v. Regents*, 293 U. S. 245. The contest in that instance was made by students and their parents, but it is not to be supposed that if it had originated in the faculty the result would have been different. Similarly, an applicant to practice law, as an officer of the state in the administration of justice, may be required to swear

willingness to serve in its armed forces. *In re Summers*, 325 U. S. 561.

A somewhat kindred subject is the right of teachers to subscribe to the now plainly inimical doctrines of Communism. Almost all non-Communists would defend a ruling of a school or college board that such doctrines must not be taught as truth, despite any possible opposition by faculty members on the basis of reliance on principles of academic freedom. But ought the result to be the same with respect to a regulation forbidding to teachers the privilege of mere membership in the Communist Party regardless of the subject taught or the method of teaching? The problem here, which in the strict aspect of American law is presumably limited to public schools, stems from the fact that, in the case of ordinary citizens, membership in the Communist Party is legally sanctioned. The Supreme Court, with guarded language, has recently approved the requirement that officials of labor unions take oaths denying membership in that Party as a condition of enjoyment by their unions of certain valuable rights. *American Communications Association v. Douds*, United Steel Workers v. NLRB, 94 L. ed. 597. It is obvious that the state is threatened by the simple potentiality of subversive efforts of Communist Party members, whether they be union officials who wield economic power or teachers who exercise moral influence. Still, one is puzzled whether the issues affecting these two callings would (or perhaps should) be similarly resolved in a particular case, absent proof of individual guilt or "clear and present danger" (as the legal phrase goes) to society.

Of course, if we assume the enactment of a valid pronouncement of general law which is applicable to the  
(Continued on page 32)

## THE CALIFORNIA ACADEMY OF SCIENCES

PRESENTS A SERIES OF TELEVISION PROGRAMS

## "SCIENCE IN ACTION"

SPONSORED BY THE AMERICAN TRUST COMPANY, a new television show produced by the Academy will appear each Thursday evening from 7 to 7:30 over Station KGO-TV, channel 7. Using the Academy's staff and facilities, with Tom Groody as Host-narrator, the programs cover a variety of topics and feature guest scientists, a live "animal of the week," and unusual science exhibits. See sponsor's advertisement.

### WEEKLY SCHEDULE:

SEPTEMBER 21, NATURE'S WARFARE EXPERTS  
SEPTEMBER 28, NAVIGATORS IN THE NIGHT  
OCTOBER 5, FINS AND SCALES  
OCTOBER 12, GOLDEN HARVEST  
OCTOBER 19, BACKYARD JUNGLE  
OCTOBER 26, STRIPED SPORT

NOVEMBER 2, ROCKET TO MARS

NOVEMBER 9, SEASHORE LIFE

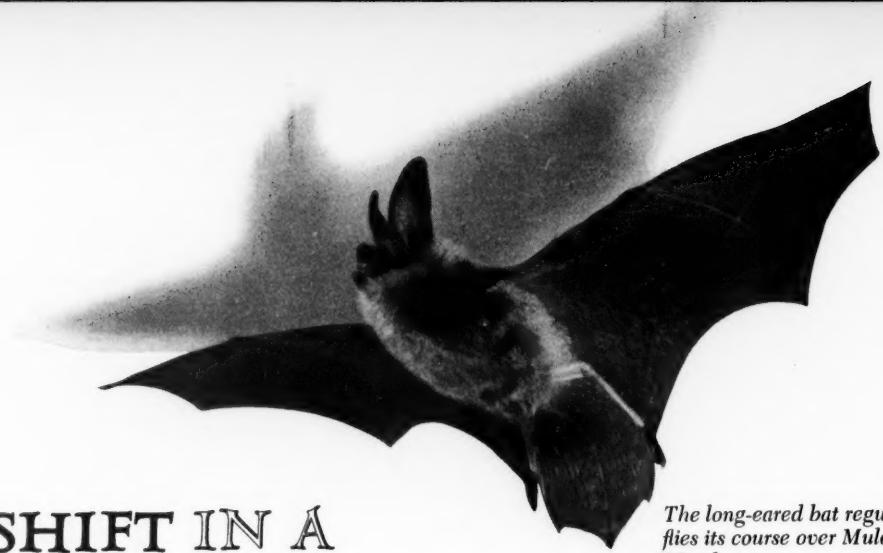
NOVEMBER 16, SCIENCE AND CRIME

NOVEMBER 23, SCIENTISTS OF THE FUTURE

NOVEMBER 30, TROPICAL JEWELS

DECEMBER 7, COPY OF NATURE

DECEMBER 14, MYSTERIOUS ATOM



## NIGHT SHIFT IN A SIERRA MEADOW

Lloyd Glenn Ingles

The long-eared bat regularly flies its course over Mule Deer Meadow on summer evenings. (Photographed in a room with an electronic high speed camera by Ernest P. Walker, National Zoological Park, Smithsonian Institution, Washington, D.C.)

MULE DEER MEADOW could as well have been the one which John Muir described as the "Jewel of the Sierra." There are hundreds, perhaps thousands, of other meadows like it in the Sierra Nevada of California. It is less than a thousand feet long and lies placidly on the south-facing slope of a wooded mountain. It is completely surrounded by thick, dark forests of lodgepole pine and red fir. Most of the meadow is wet and, except for a few higher places supporting clumps of willows, it is covered with various sedges, mosses, and other herbaceous hydrophytic plants. Because it is warmer, moister, and has higher intensities of light than the encircling woods, there is a great population of insects concentrated in it throughout most of the snowless months. It is in and around this forest-edge community that the pileolated warblers, white-crowned sparrows, and warbling vireos nest in summer. It is here the fox sparrows, green-tailed towhees, and Clark nutcrackers come each autumn from higher up on the mountainside to get their fill of the plentiful food. It is among the tangle of willow branches that the winter wren finds its sustenance even as the deep snows fall. It is here also that the first western tanager of the spring preens its feathers in the warm morning sunshine after its long flight in from Guatemala. But these creatures represent the day shift of the animals that work the meadow

and are familiar to all who frequent meadows in the Sierra Nevada of California. Who takes over on a night in June after the last liquid notes of the Sierra hermit thrush are committed to memory? Who starts to work on a night in September after the Douglas squirrel has sent his last Jeffrey pine cone crashing two hundred feet down to earth?

With the dusk bats appear. An owl hoots in the distance. The mule deer quietly slips into the meadow from the forest. Occasionally a gray fox or a skunk prowls at the margin in search of food. Mountain beavers and pocket gophers peek out from their burrows. Although the day is gone there is still activity, and it is the occupation of these sly workers who do night shift that commands our attention.

IT WAS EARLY IN SEPTEMBER when we were in Mule Deer Meadow with cameras and flash bulbs. Hardly had the baits been spread in front of the cameras before the first nocturnal creatures began to appear from the black wall of fir foliage. They were long-eared bats (*Myotis evotis*). We watched their angular wings as they cruised about catching flying termites from the woods and high-flying moths emerging from the willows and grasses below. Soon we were aware that we were looking at the same three bats, each slowly flying around an oval course some fifty to sixty yards long. Although

their hunting ranges overlapped when projected on the ground, actually they did not do so because each range was flown at a different level. If a bat swooped too high or dived too low into the level of the flight flown by one of the other bats it was immediately pursued by the owner of that range-level until the intruder returned to its own forage range. Subsequent observations at other parts of the meadow on other nights showed that they too had their bat hunting-ranges at different aerial levels.

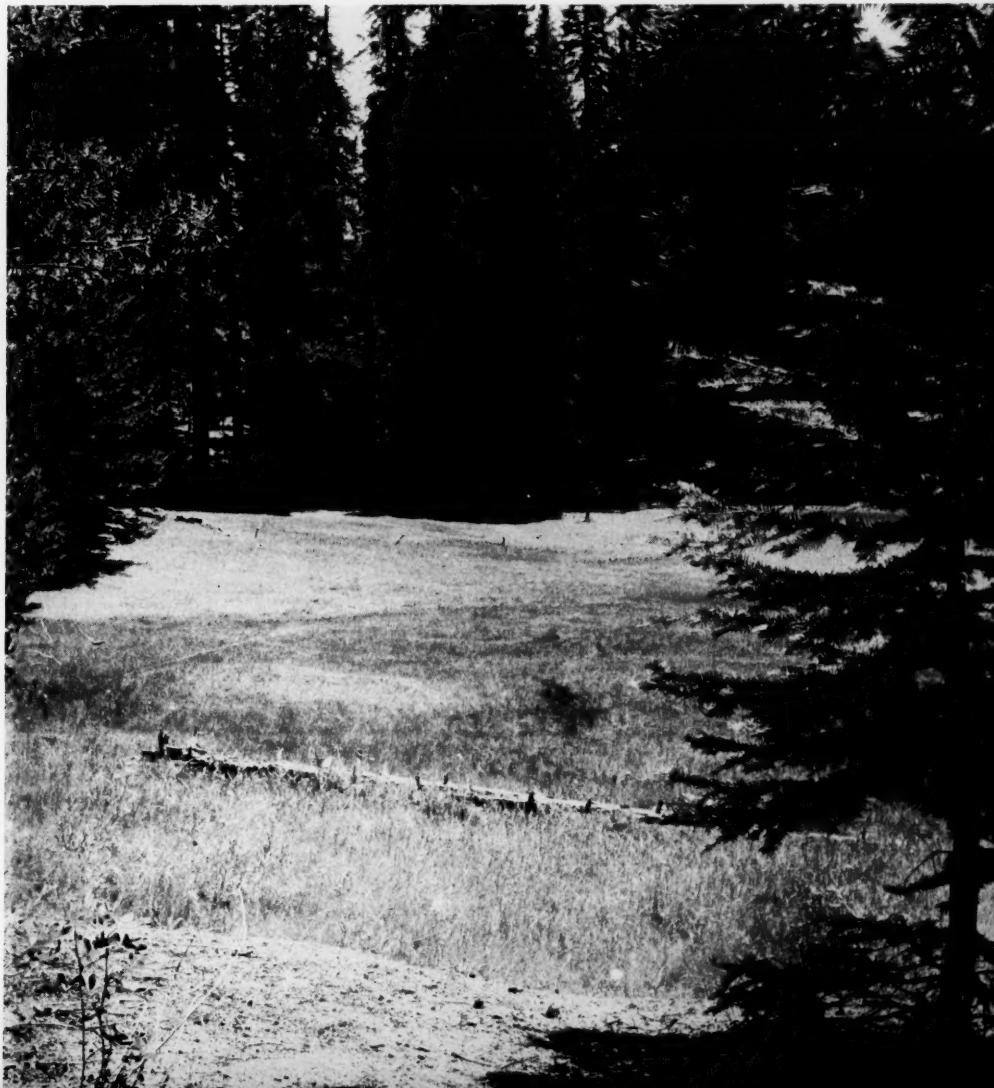
How long these bats fly these "cloistered flights" on September nights is not known. Early darkness limits observations, but this we do know: the down-mountain currents of cold air soon quiet most of the flying insects and then the long-eared bats begin to search for insects in the warmer air of caves, tunnels, or even about the warmth of camp fires. Whether these are the same bats that fly regular individual courses during the first hour of dusk, we don't know. It seems that the foraging

period might even be limited to an hour or so at this time of year, and as the season advances the hunting time becomes so short the bats are finally forced to go to winter quarters. Where? No one knows.

While the long-eared bats were still darting about, a large dark bird flying a few feet above the ground crossed the upper end of the meadow. This was a horned owl, largest and most powerful of the local nocturnal avian predators. Two horned owls lived in the forest around the meadow and their deep-voiced hoots could be heard almost every evening in every month of the year. Sometimes the dog-like yelps of a spotted owl could also be heard, but whether it was a permanent resident of the forest around the meadow was never determined. Horned owls are found in wooded areas ranging from the stream-bordering cottonwoods in the San Joaquin Valley up to timber line in the Sierra. Around Mule Deer Meadow the horned owls at this time of year probably

**Photographs  
by the Author**

*Mule Deer Meadow—  
where we watched and  
photographed the  
night-shift animals—  
is completely surrounded  
by thick, dark forests  
of lodgepole pine  
and red fir.*



preyed on the Douglas (red) squirrels that frequently worked until after dusk and always came out early before sunup. One owl was seen successfully chasing a flying squirrel which beat its pursuer to the trunk of a large tree. None of the marked pocket gophers that lived around the meadow were ever captured by predators during the summer and autumn months, but in winter their numbers were reduced by half and horned owls may have played a part in the reduction of the gopher population. Horned owls are frequently collected with the odor of skunk on their feathers, indicating that even these strongly scented mustelids are on the owls' menu.

Of all the animals on the night shift none are better known or better liked by the people who come to Mule Deer Meadow than the mule deer themselves. Each summer afternoon a doe with her two spotted fawns browsed in the willows near the mountain beaver colony. As evening approached other does and fawns came too, but it was never until dark that the three bucks came down from the ridge. Then, if the wind shifted, bringing human scent, one of them would snort and all three would go crashing wildly up the mountainside. But the does would continue to browse unafraid. The mule deer liked the variety of diet provided by the meadow each summer. They liked to browse on the tender willow leaves, the sedges, the shooting stars, and to graze in the tall grasses. Before the deep snows came, however,

they would move down the mountains to their breeding grounds miles away at much lower levels. They were only summer and fall residents of Mule Deer Meadow.

One of the surprises came one evening when a gray fox sneaked out of the chinquapin at the edge of the woods to share the baits. This fox was very timid and invariably ran back to cover with each flash and click of the camera; nevertheless, it repeatedly came back for more food. Gray foxes are common in the foothill woodlands and chaparral but are certainly not to be expected in red fir forests, though I recall seeing a gray fox a few years ago near Morro Rock in Sequoia National Park, at an elevation of about 6,500 feet.

Whether our fox regularly lived around the meadow or was merely a wanderer, we could not tell. There is some reason to believe gray foxes may, over many years, have gradually followed the Beechey ground squirrels up from the valleys.

Mr. Clarence Fry, an old-time ranger in Sequoia National Park, says that formerly there were no Beechey ground squirrels in the Giant Forest. Later these ground squirrels followed the horse trails (eating spilled grain) even into the higher back country. Certainly there are more of them now near trails, corrals, and places of habitation in the mountains than elsewhere at the same elevation. It is also certain that these rodents are an important food item for gray foxes in the lower chaparral belt. One evening about sundown one

*The red squirrel frequently worked until after dusk and always came out early before sunup. He has found it pays to cut sugar pine cones down before they ripen and scatter their seeds*





*The mule deer themselves are among the best known animals of the night shift.*

of these large ground squirrels was seen to climb rapidly as far up as it could in a clump of deer brush. Almost instantly a gray fox catapulted from the dead grass, snatched the terrified ground squirrel, and trotted away with a dinner.

When a striped skunk showed up one evening at the rock where the baits were spread, it was expected. A skunk had been seen here, weeks earlier, digging for insects late in the afternoon before the snow had all melted. The presence of the skunk in the meadow was not hard to explain now because grasshoppers were there in abundance. Skunks occasionally hunt for grasshoppers not only at night but in the early morning and late afternoon. In the mountain meadows the grasshoppers are easily caught at night because the low temperature makes them sluggish. At

lower elevations skunks are active more or less the year around. Here, however, where the ground is covered with 100 inches of snow for months each winter, the animal probably goes into a prolonged period of sleep and reduced activity that uses up much of the fat acquired during the summer and fall months.

Other than the horned owls the skunk probably has few enemies at Mule Deer Meadow. It was not frightened by the flash bulbs or the cameras. It merely elevated its tail a bit higher and struck the ground audibly with its forefeet, but kept right on feeding.

Another animal that begins to work early in the evening and frequently continues to work until late the next morning is the mountain beaver (*Aplodontia rufa*). The willows at the lower end of



Striped skunks stay in the forests around the meadow all winter and frequent the meadow in summer to catch grasshoppers.

FACING PAGE: The gray fox is not usually found in the red fir forests of the Sierra. We did not know whether this fox stayed all winter at the altitude of red fir.

Mule Deer Meadow had a small colony of these strange rodents living in wet burrows beneath their roots. These animals are nearly tailless and are about the size of a muskrat. They belong in a family of their own without any near living relatives. Except that they are rodents and usually live near the water, they have very little in common with the better-known true beavers (*Castor canadensis*).

In late summer the mountain beaver begins to gather a variety of plants such as lupines, sedges, grasses, willows, and deer brush, which it piles up in a "haystack" to cure before storing in its burrow. Presumably this material is used for food during the winter months, but it also may be used for a nest. That these animals do not hibernate and do not depend entirely on stored food is demonstrated by their midwinter work. Early in April while the snow was still over five feet deep the colony was alive with nocturnal activity. Each

night the rodents gnawed the tender bark and shoots off the willows while sitting on the frozen snow. One burrow over 100 feet long was found under and through the snow. The four young white fir trees which this snow burrow led to were entirely stripped of bark and much of their foliage. The tallest of these little trees was about six feet high and it had a burrow coming straight up along its trunk which was devoid of all bark.

Most numerous of the animals that worked on the night shift at Mule Deer Meadow were the mountain pocket gophers (*Thomomys monticola*). These were also the least conspicuous because nearly all of their short lives are spent underground or under snow. Only rarely do they ever leave their burrows, even at night. Generally all one sees of a mountain pocket gopher is its be-whiskered snout as it pushes earth from the burrow system late in the afternoon or early in the morning.

By the middle of August there were nineteen pocket gophers that had established their individual burrow systems in and around the margin of Mule Deer Meadow. All had been live-trapped and marked for special study. Most of the meadow was too wet for their permanent burrows. Although they frequently push mud out of a burrow, they never establish a permanent system in earth where the water table is less than 4.5 feet below the surface. The area of an individual burrow system ranged from slightly more than 100 square feet for young animals to somewhat more than 2,000 square feet for old established females. There were only about 25 areas at Mule Deer Meadow that were large enough and dry enough to provide suitable home ranges. During the three years we studied the pocket gophers all of these ranges were occupied, but never all at the same time. The only times when the animals move away from their home ranges are in early spring when the males are searching for breeding females, when the young pocket gophers are dispersing from the maternal home range, and when in late spring the melting snow and rising ground water force them to retreat to higher ground among the trees. It is at these times, winter and spring, that mountain pocket gophers are most vulnerable to predators. Indeed, the population is roughly reduced by the middle of June to about half what it was the previous November. Breeding males are much less

frequent in the population than adult females, possibly because of their greater vulnerability and probably because they kill each other in fights. Two adult males were placed in the same cage during the breeding season. They fought like bulldogs until one cut the throat of the other in less than 30 seconds.

The most interesting thing about the mountain pocket gopher is its relation to the conservation of soil and water. It is continually burrowing for its food which is comprised of many kinds of plant roots, rhizomes, bulbs, and stems. Sometimes it pushes the earth above the ground to make the well-known gopher mounds. At other times, however, it pushes the extra dirt into old burrows or up into burrows made in or under the snow to leave the curious sausage-like "gopher cores" after the snow melts. These gopher artifacts are familiar to all who go to the Sierra in early summer. The burrow systems allow the spring runoff water to get into the soil, which enables springs to flow continuously throughout the year. Unless one has been on a mountain meadow in the spring when the last snow is melting he can probably never appreciate the importance of the mountain pocket gopher as a conservator of water.

Last June at the upper end of Mule Deer Meadow a little stream carrying perhaps a gallon per minute was observed disappearing into a large gopher burrow system. The stream continued to





▲ UPPER: The mountain pocket gopher rarely shows more of itself than its head. This one is pushing up fresh earth to plug its burrow. LOWER: Gopher cores are made in winter when the animal plugs with earth a burrow tunneled in or under the snow. When the snow melts the long earth ridges are left on the ground.



run into that system for over two weeks and it was never found running out at a lower elevation. That water was "stored" to seep to the surface continuously during the summer months and thus to sub-irrigate the lower end of the meadow and to keep its plants green and lush.

Joseph Grinnell, Tracy Storer, and other California naturalists long ago pointed out the importance of the pocket gopher in the formation of soil. At Mule Deer Meadow a single half-grown mountain pocket gopher in eight days early in August brought to the surface exactly 100 pounds of earth. Some of the adult animals were bringing up even more. The nineteen gophers around the meadow were bringing up about a ton of earth every eight days.

Most of the soil brought to the surface at Mule Deer Meadow contains little humus but many small pieces of decomposing granite. Exposure to rain and snow, to freezing and thawing, to sunlight and wind, breaks these little rocks into still smaller pieces to become soil. Humus is added when this mineral soil is mixed with the decaying vegetation on the surface and thus the meadows become richer. As patches of a meadow become drier because the water sinks deeper into the gopher burrow systems, more areas attract more pocket gophers and more soil is made rich, which increases and enhances the variety of plants growing there. Grasses, for instance, replace the mosses and sedges on the drier places, and the meadow attracts animals that eat grass, including grasshoppers and moths and the animals that prey upon them.

Although pocket gophers are pests in agricultural regions, this little fossorial rodent of the mountains is a valuable creator of soil and conservator of water in the beautiful meadows of the Sierra. It is a basic animal in the food chains at Mule Deer Meadow. It prepares the soil and helps



◀ 1  
the  
burn  
and  
(Ern

provide continuous water for the plants on which the pocket gopher itself and all the other animal species depend for food. It is an important animal in the well-being and economy of most plant and animal communities in the red fir and lodgepole pine forests of the Sierra Nevada of California.

NO ONE KNOWS HOW LONG the nocturnal animals continue their activity in the meadow on summer nights. Hunting time for the long-eared bats, for example, may be limited to the early hours each evening. Long before the frost forms on the grass blades the last bat has probably darted through the thick foliage to come to rest, head down, under a loose piece of bark on a dead fir. The horned owls are at least sometimes awake until daybreak, for the pair frequently "talked" to each other after the rosy dawn had filtered over the Sierra crest. Their roosts were never found, for hundreds of firs around the meadow provide excellent daytime retreats for them. As already indicated, the gray fox may have been a transient at the meadow. While it was there, however, it doubtless took full advantage of the thick clumps of chinquapin and snow brush where it could sleep in the warm sunlight practically unmolested. The skunk retired from Mule Deer Meadow relatively late. It seemed reluctant to quit hunting as it ambled slowly up the hill in full sunlight to the burrow beneath the large granite boulder which was its summer den. The mountain beaver also worked in its half-open, caved-in burrows even when the sun was shining. Rarely did it venture as far from its retreats in the daytime as it did at night, for it was by preference a night-shifter. Most of the mule deer generally retired to their favorite beds in the snow brush upon the hillside shortly after sunup. A few occasionally remained in the meadow all day but there were always more present at night.

---

#### ILLUSTRATED BOOKS FOR FURTHER READING

GRINNELL, JOSEPH, JOSEPH DIXON and JEAN M. LINSDALE. *Fur-bearing Mammals of California*. University of California Press, Berkeley. 1937.

GRINNELL, JOSEPH and TRACY I. STORER. *Animal Life in the Yosemite*. University of California Press, Berkeley. 1924.

ORY, ROBERT T. *Mammals of Lake Tahoe*. California Academy of Sciences, San Francisco. 1949.

INGLES, LLOYD G. *Mammals of California*. Stanford University Press, California. 1947.

---

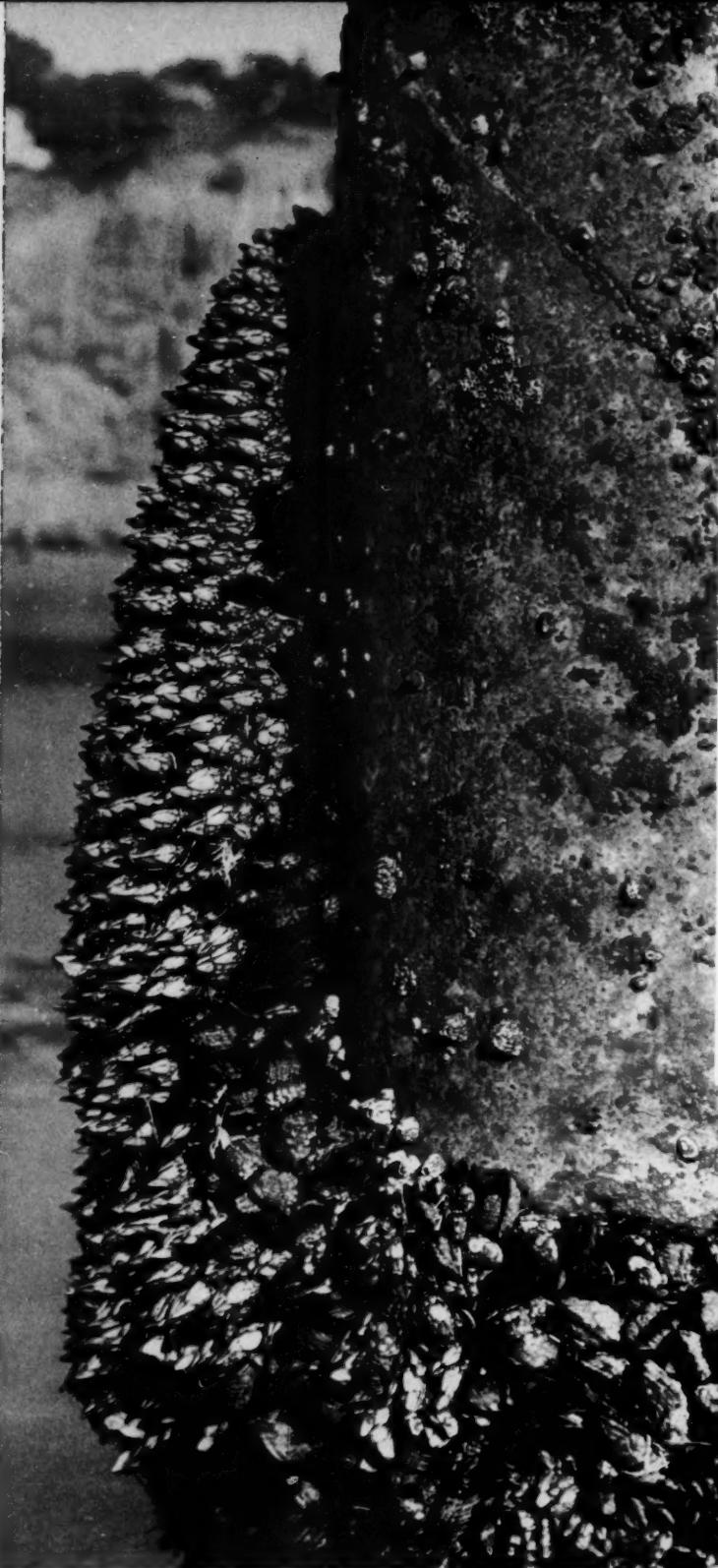
◀ Mountain beavers, active all winter, live in wet burrows beneath the willows at the lower end of the meadow. They frequently make long burrows in the snow to reach young fir trees which they strip of bark and foliage. This strange rodent has no close living relatives.  
(Ernest P. Walker, National Zoological Park, Washington)



The horned owl is as much at home in the red fir forests as in the cottonwoods and willows in the hot, dry valleys.

How the time of day could make any difference to a pocket gopher in its dark underground burrow is difficult to understand, yet the great majority of the fresh mounds made by these little tunnel-diggers were made between the late afternoon and the early morning hours. Like the other night-shift creatures it too had inherited a behavior pattern that called for nocturnal action as a part of its adaptive make-up. Thus each one of the animals on the night shift has structural and behavior characteristics that fit it to its particular niche in the meadow. The meadow community is comprised of all these interrelated patterns of reaction to the physical and biotic environments. Any one animal in the meadow depends in some way on all the rest, and when unmolested the Sierra Community functions smoothly as it doubtless has done for thousands of years.

END



M. WOODBRIDGE WILLIAMS

## They Stand on Their Heads

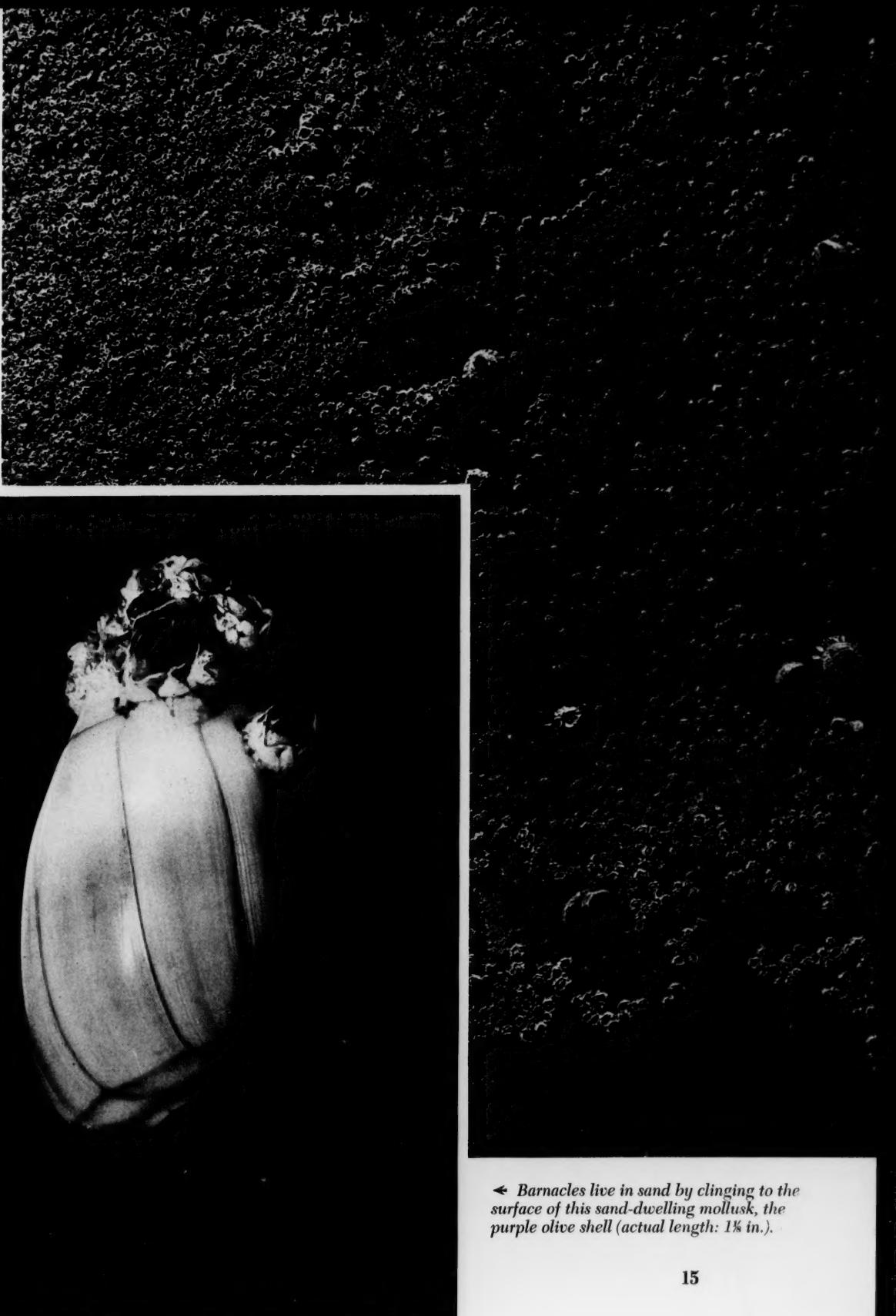
PERHAPS NO GREATER CURIOSITY EXISTS in the sea than animals which spend their entire adulthood standing on their heads. Yet to the casual observer this condition of the commonplace barnacle is not obvious. In fact the true position of the barnacle in the animal world fooled even biologists until 1830 when J. Vaughan Thompson examined barnacle larvae and found they were actually crustaceans, and therefore related to crabs, lobsters, and shrimps, not the mollusks—clams, snails, and their kin—as even the experts had supposed before then.

For the barnacles in their early stages swim freely in the ocean, the larvae closely resembling those of other crustaceans. Only after the infants settle upon a solid surface do they develop their shells of many plates and assume their peculiar stance. Thomas H. Huxley aptly described a barnacle as "a crustacean fixed by its head, and kicking food into its mouth with its legs."

The photographs on pages 16 and 17 show the strange procedure through which the newborn barnacle must pass before it achieves its topsy-turvy position among the sessile marine societies which cling to rocks, pilings, and ships' bottoms.

*This concrete wharf piling at Scripps Institution of Oceanography, La Jolla, California, carries the "upper littoral zonation" of barnacles. Highest on the pier are acorn barnacles (*Balanus*). At the base and creeping up the sheltered side are goose barnacles and mussels.*

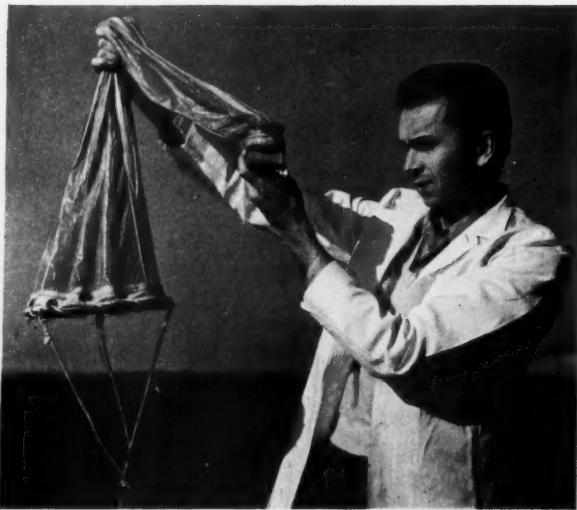
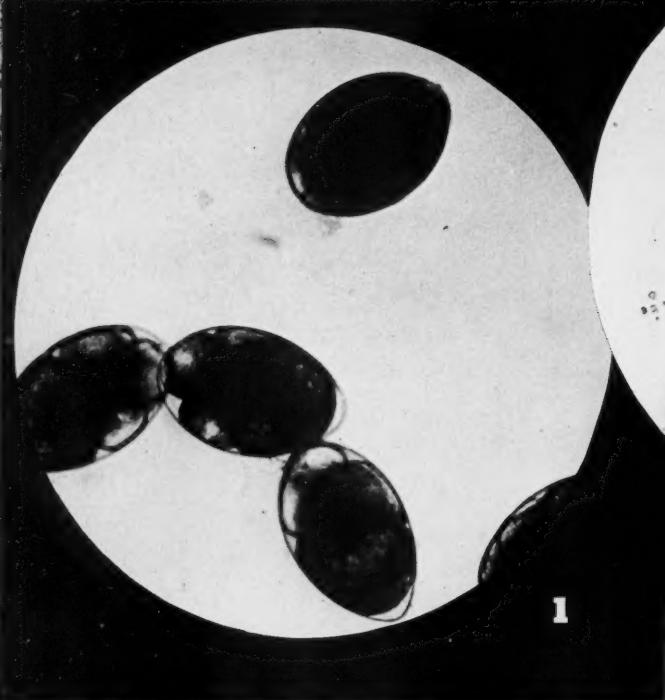
Acorn barnacles  
(*Balanus glandula*),  
the smaller form,  
and a larger one  
of the same genus  
live near high  
tide line, along  
with the limpet  
(*Acmaea digitalis*)  
at La Jolla.



◀ Barnacles live in sand by clinging to the surface of this sand-dwelling mollusk, the purple olive shell (actual length: 1½ in.).

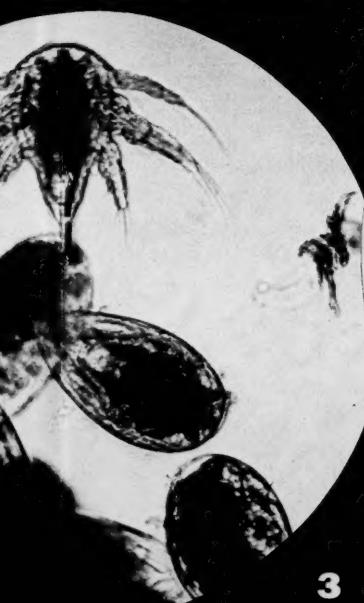
**1.** Barnacle eggs may be found by cracking open a barnacle and examining under a microscope the tissue at the base of its shell. (No need to distinguish sexes—most species of barnacles are hermaphrodites, one animal having both male and female sex organs.) Fertilized eggs in the photomicrograph are passing through the cleavage stages—first divisions of the egg cell, which initiate a series of fascinating changes in the barnacle's progress toward adulthood. (The eggs are from *Balanus tintinnabulum*, a large acorn barnacle distributed around the world.) **2.** Cell division has pro-

duced tissues and structures. The young barnacle larva is now complete, including the black eyespot in the center of the head. Under the microscope the embryonic barnacle can be seen stirring restlessly within the membrane of the capsule-like egg. **3.** Kicking its way out of the egg, the baby barnacle

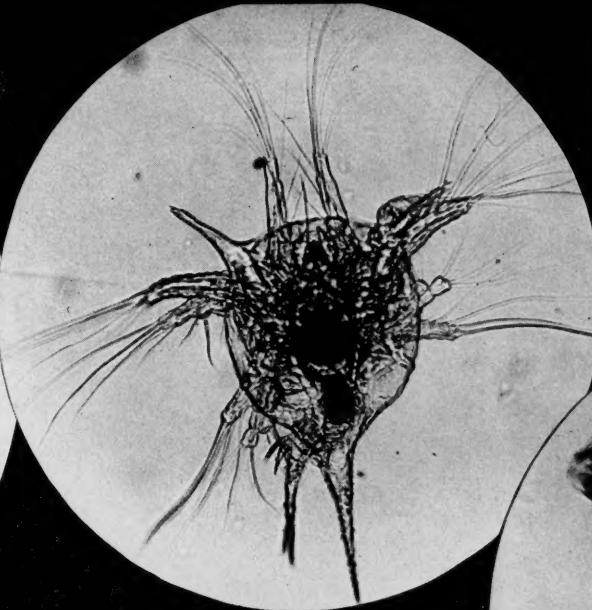


Off the pier at Scripps Institution of Oceanography, Biologist Ben Olson examines a plankton haul. The fine mesh caught the cypris in #5.

begins to dart rapidly about as a free-swimming larva—very different from its parent both in looks and in habits. In this first stage after leaving the egg it is called a *nauplius*. The nauplii pass through several growth stages which biologists number 1, 2, 3, etc. Each nauplius stage ends in a molting when the chitonous exoskeleton is shed, and the growing tissue of the animal expands before the new skeleton hardens. All crustaceans grow in this way. **4.** The *nauplius* has now passed through several stages and is about three times the size of the first stage *nauplius*. This stage is reached within the brood pouch of *Balanus tintinnabulum*, but not long afterwards the adult releases its young into the sea where they rise to the surface and become part of free-floating plankton. The horns on the barnacle *nauplius* distinguish it readily from the *nauplius* of the copepod, another minute crustacean, which is free swimming throughout its life. In the photomicrograph several organs are conspicuous. Surrounding the eyespot is a light area, the brain. Back of the eye is a dark area, the stomach. The digestive tract extends as a straight tube from the stomach to the large spine at the posterior end of the *nauplius*. The front appendages are called the *first antennae*—they play an important role in the next stage. **5.** *Metamorphosis*. Before the young barnacle becomes attached to a solid surface, the *nauplius* goes through a remarkable metamorphosis to form another free-swimming stage, the *cyparis* stage. This is formed when the carapace (back) of the *nauplius* folds, producing a two-piece shell which resembles the halves of a tiny clam. The *cyparis* develops six pairs of biramous swimming appendages, which it can withdraw into its shell or



3



4



5

extend at will, using them to propel itself rapidly through the water. The "boxing gloves" protruding from the front are the modified first antennae which have developed adhesive discs by which the larva first attaches itself. Soon after, fixation becomes permanent when a cement gland at the base of the first antennae secretes an adhesive. The clam-like shell covering, swimming appendages, and antennae



6

are then shed; and the soft tissue surrounding the animal—the mantle—begins to secrete the six plates making up the barnacle shell. In place of the swimming appendages, *cirri* appear, their new function the gathering of food. An interesting feature in the photograph is the three eyespots toward the front of the cypris. (The species shown is unidentified; it was taken in a plankton haul off La Jolla, California.) 6. *The adult barnacle*, feeding. The cirri of *Balanus tintinnabulum* protrude into the water to sweep bits of food toward the mouth. Their motion is extremely rapid as they are alternately thrust out and withdrawn. These cirri are the former swimming feet of the larval stages; now the barnacle stands on its head—for life!

## Passage to São Tome

BORYS MALKIN

ON THE LAST DAY OF JULY, 1949, I sailed from Douala in the French Cameroons for the Portuguese island of São Tomé in the Gulf of Guinea. The new, clean, and shining Norwegian motorship *Marianne* is a freighter which also carries a limited number of passengers (up to 12) comfortably enough. Nevertheless, I felt miserable, being a poor sailor and suffering from the wicked climate of low-lying and landlocked Douala which is a considerable distance from the sea, up the river, surrounded by mangrove swamps; its oppressively humid climate, with a 160-inch rainfall, is not relieved by wind. Fortunately I sailed from there the only passenger, free of restraints to comfort ordinarily imposed by shipboard etiquette.

São Tomé is only 300 miles southwestward from the mouth of the Cameroons River, and the following day the island's great pyramidal hulk appeared ahead. Since there is no harbor for anything but tiny craft, ship passengers and cargo are landed from motor boats or lighters, a half-hour trip through rough seas.

Landing provides unexpected contrasts for a visitor accustomed to the ugly towns and settlements of the low West African forest belt. Here in this island port was less corrugated iron and more brick—the Portuguese transplanted "alive" their native architecture. The pastel coloring of the houses, usually pink, yellow, or orange, sometimes light green, is lively against the dark background of the mountains. Two ruinous 15th century fortresses along the boulevards have witnessed the long-standing Portuguese occupation. All this I found very pleasant, together with the fresh sea-breeze which accounts for the relatively fair climate although the island is practically astride the Equator, its latitude being 0°2' to 0°25' N.

Once landed, the problem is where to go and where to stay. Following suggestions of my friend Mr. W. H. T. Tams, a lepidopterist of the British Museum who, with the botanist Mr. Arthur W. Exell, was the last naturalist to visit these islands before me, I believe (in 1932), I set my mind on Roça Zampalma, a plantation somewhere above 2,000 feet in the mountains, and on a smaller plantation called Macambrará, still higher. While I mulled over these problems, still in the motor boat, Mr. Charles, the interpreter for Lima & Gama Ltd., agency for the steamship lines, came to my aid. By the time we landed he was ready with some sort of plan. He took me over to the company's office, where a conference in Portuguese ensued of which I understood precious little. His boss Senhor Tancredo Moreira and Senhor Hugo Lacerda Cruz, another member of the establishment, promptly settled in their minds what to do and led me off to an elderly gentleman, Senhor Americo Brandão, and his

son Raul, owners of the Roça Zampalma. Before I knew what was happening the old planter said, "Okay, day after tomorrow Raul will drive you over to the Roça in the jeep." So it was.

That gave me two days to wander about town, the *cidade*. A lovely boulevard ends up in a road fringed by a row of coconut palms which leads along the coast toward the southern part of the island.

Walking to the ruins of the fortress of São Jérónimo, I got a quick mental flash-back to the times of João de Santarem, a Portuguese mariner who was the first European to sight this tiny island either at the end of 1470 or early in 1471. Then the island was densely covered by tropical forest and totally uninhabited. Five years later came the first abortive attempt to colonize, but permanent settlement did not take hold until almost 25 years after discovery. The *cidade*, São Tomé, capital and chief port, is now 450 years old.

From the *cidade* I went off in a jeep to Roça Zampalma as scheduled. The road, very narrow and winding, leads first through innumerable cocoa plantations in the hot low country until it enters misty forests where, in a cooler climate at 2,000 feet and higher, coffee—"of splendid quality"—is planted. Until after the turn of the century cocoa was the foremost produce of São Tomé, the island holding second place, in 1912, in world production; now, however, it is far behind the leaders, Gold Coast and Nigeria. Cocoa, planted here very early as well as coffee, resulted in practically complete destruction of the native forest except high on the mountain slopes. The forest is cleared except for an arboreal canopy left to protect the cultivated plants from the sun. With this forest must have gone the smaller plants it harbored and its fauna—prospects of preserving much that is peculiar to the island are very grim. But more of this later.

We came to the large house of the Roça Zampalma where I lived for the remainder of my stay on São Tomé, all but one 24 hours and a last memorable night. Senhor Battista, the supervisor, and his wife took great pains over my comfort and convenience. In helpfulness and hospitality they outdid even Portuguese custom—and the Portuguese I found the most hospitable of any people I've met in Africa or elsewhere. The Battistas—just one example—asked me which I preferred, coffee or tea. Tea it was—I am a fiend for this drink, perhaps because of my Russian origin and early association with the samovar. Next day a foot messenger was dispatched to the *cidade*; he returned with both black and green tea, so I could have my choice!

Except for a few trips higher up I did most of my work around Roça Zampalma. Coffee and bananas

mingle here, and much clearing is done by the "native" laborers, which include many imported from Mozambique, Angola, and the Cape Verde Islands. The native vegetation was pretty much gone, but there were enough logs and stones to provide some collecting. And as usual I tried hard for aquatics, first in a stream and later in the small, shallow Lagôa Calvario—only lake on the island—on the adjacent plantation, Nova Celyão.

The aquatic fauna is very poor, as is usual with oceanic islands. Besides, little work in this field has ever been done in the Guinea Gulf islands, Fernando Po, Príncipe, São Tomé, Annobon. No surprise, then, that when I netted several hundreds of aquatic beetles from Lagôa Calvario, representing perhaps a dozen species, most of the forms turned out to be new records for the island group and all of them new to São Tomé. Superficially, they all looked to me very much like the mainland forms I collected in Nigeria and the Cameroons, but the final verdict waits thorough study by specialists.

Otherwise, Lagôa Calvario was a futile effort. A large number of dragonfly nymphs swarmed in it but there were few adults on the wing. Most striking and unaccountable was the absence of aquatic bugs (Hemiptera); this may have been because it was still the dry season.

A stream near Roça Zampalma confirmed the island's paucity of aquatic insect life. The only beetle belonged to a genus of the whirligig family, but again I suspected identity with the mainland form. A few minute water bugs were added to the collection here, but my largest prey were two species of prawns and a goby two to four inches long. This fish excited me a great deal at the time and I went out of my way to secure more specimens. I knew that only two species of freshwater fishes have been described from São Tomé and I suspected a rather interesting find. Later, checking this one at the South African Museum and at the British Museum in London led to one conclusion—a new species. It has a curious adaptation: the pelvic fins unite to form a suction cup, showing distinctly the type of habitat for which this goby is fitted—swift, rocky, mountain streams. Its body is thickest from side to side.

Most of my additional specimens of the prawns and fishes I got from the Negroes who fish for them with nets to add to their meager supply of meat, the bulk of which comes from wild descendants of introduced domestic pigs, running in the forest.

The stream I mentioned was considerably above Roça Zampalma; a little below, an orange grove offered hiding ground for innumerable hard-shelled spiny spiders of the genus *Gasterocantha* which swing their webs between the trees. The female of this species is large and spiny, the male tiny, insignificant, and therefore rare in collections. I took a large num-

ber of the females. Their heavy concentration within the orange grove and great rarity outside of it suggested the possibility of their introduction from elsewhere with the oranges—but this is another problem for specialists.

After more than a week on Roça Zampalma I transferred my activities to the spot called Macambrará, although not for very long—there was a surprise in store.

The road ends for motor traffic a few hundred yards beyond Zampalma, and to Macambrará (4,000 feet in elevation) there is but a narrow trail where even a horse has difficulty in places. Up I went, nevertheless, on horseback, with a guide and three natives in the lead carrying my baggage on their heads. The trail passes entirely through forest of a different type from that below, with parasitic plants, epiphytes, orchids, creepers, vines, and beards of mosses increasing as we go higher up. Orchids and begonias are native here—begonia lovers may be reminded that the original home of the latter is the West African mountains (they are also native to Peru). The quinine bush was planted all along the way; according to Messrs. Tams and Exell<sup>\*</sup> the cinchona was even planted on Pico de São Tomé (altitude about 7,000 feet), the island's highest point. Cinchona bark was once an important export.

Fantastic in its curves, the trail is carved out of the face of a cliff 3,000 feet high and very steep. As we went higher I looked down upon the buildings of the Roça Zampalma, actually quite large yet looking very tiny from the perpendicular heights. At 3,000 feet my guide called my attention to the *bicho* (everything that crawls or walks is called *bicho* by the Portuguese just as it is called *beef* in the pidgin English of West African Negroes).

"Cobra!" the guide yelled at first. But instead of a deadly snake I picked up a harmless caecilian, a limbless, burrowing amphibian with small eyes and a fat, stubby tail—the combination makes it hard to tell one end from the other. Segmented and yellow, blotched with brown, it looked more like an oversized earthworm than any cobra. Its family, Caeciliidae, is limited to the tropics; the specimen we encountered is now the first of its species in the Academy collection. Parenthetically, the Oxford University zoölogical expedition which came to São Tomé shortly after I was there collected more than twenty and managed to get them all back alive to England.

At Macambrará I squeezed into a tiny, once white, now gray house. Nights being cold, I was glad I'd brought my sleeping bag up with me. Here, and for some distance above, the planting was coffee, and the Negroes were clearing land for more. But beyond the upper edges of the plantation stood patches of undisturbed mountain forest.

\*Arthur Wallis Exell, *Catalogue of the Vascular Plants of S. Tomé* (London: British Museum, 1944), pp. 113, 231.

Turning stones revealed a good many daddy-long-legs and ground beetles, then up I went, higher, sweeping in the forest and turning logs over like mad. The fauna was scarce here and the work hard although in the cool climate not unpleasant. But it paid me well because at this altitude practically everything I collected was new to me and probably endemic to the island—compensation for the relative fewness of specimens.

One day with my guide and a carrier I started off for Lagôa Amelia. Up and up the steep precipices we climbed endlessly, with clouds and mist obscuring the view below and hiding the deep canyons and chasms. We came at length to the rim of a crater and swung over and down into the interior.

Lagôa Amelia, once a crater of a small volcano now extinct, had been filled with water, like Oregon's Crater Lake; but being at relatively lower elevation (4,800 feet) and virtually on the Equator it promptly succumbed to the invasion of profuse plant life and became a bog. One can walk on it readily, although it shakes at times and might give one an uneasy feeling.

This being early in the afternoon I lay down in the tall grass right at the edge of the "lake" to rest. A lovelier spot would have been hard to visualize.

The steep walls of the small crater are densely covered with virgin forest peculiar in nature to the island. Bright green tall grass spreads over the Lagoa like a beautiful rug, contrasting with the darker rim of the crater and patches of invading trees, bushes, huge begonias; as climax, handsome large tree-ferns invade the rug-like design. Mist comes and goes now above, now below, and frequently a tree seems suspended in air.

A few birds, certainly endemic to the island, sounded from the forest, and I couldn't help thinking what will happen in the near future to this enjoyable sanctuary of native wildlife. Creation of a national park would be in order, with little expense in money or energy. Lagôa Amelia is small and it would suffice to enclose but the top of the outer rim with all it contains in protective boundaries. Oceanic islands are in a bad way nowadays with rapidly expanding populations and cultivation. Here already the cinchona plantings touch the rim, and even the coffee in places; quite probably they will soon move farther in.

The oceanic islands are small and their limited and peculiar fauna and flora are readily destroyed. What has happened in a general way in Hawaii, St. Helena, Aldabra, or Mauritius and Réunion, what is happening in the West Indies is repeated on São Tomé—the lowland forest is entirely destroyed, the upper and more distinctive high forest pretty nearly so. Authorities call this flora highly endemic, and the fauna is very much of the same order. Little is known of the smaller world such as insects; but the land birds—

more than 40 species—are endemic to such an extent that only eight of them are found also on Principe only 90 airline miles away. It is not hard to see what the introduction of domestic animals such as pigs or vermin such as rats is doing to the bird population. Nests are so vulnerable.

To my knowledge, no movement whatever has been organized in the mother country for the protection of a few remaining unique and fascinating spots on Principe and São Tomé. There is much talk about attracting tourists, yet a park like that I visualized for Lagôa Amelia might have been an attraction—and nothing is done about it nor is it likely that anything will be done. And so I mixed pleasant and gloomy thoughts about this lovely place.

Somewhere in between I tried to think about the hows and whys of all this. How did the island originate? There is considerable difference of opinion about this and well documented evidence is scarce. Geologists generally believe that it had stood out all by itself since Mesozoic times, a growing volcano, and then became colonized by plants and animals. But it might have been, on the other hand, one of the high peaks of a submerging part of the continent. The generally straight NE by SW line, formed by the four Guinea Gulf islands, Cameroon Mountain on the very edge of the mainland, and the Adamawa highlands inland in the Cameroons, speaks for both possibilities.\*

Whatever happened, it happened a long time ago—the bird fauna alone would be strong evidence of this if there were no other. During the entire two weeks on the island I listened in vain for the voices of hornbills; those birds so characteristic of the mainland opposite the island do not occur on any of the Guinea Gulf islands, excepting Fernando Po a little over 25 miles from Victoria, British Cameroons.

After a good rest we started down. This was somewhat harder than climbing up owing to the steepness of the slope and the slippery grass covering it. We could see little of what was below because of passing clouds.

\*Exell, *op. cit.*, p. 5. "There is no doubt that all [the Guinea Gulf islands] are of comparatively recent volcanic origin, and they almost certainly arose in the Tertiary epoch. This is borne out by their topography, by the precipitous scarcely eroded mountain-peaks, the well-marked sharp-rimmed volcanic craters and the numerous waterfalls. Moreover, volcanic activity has not entirely ceased, for small eruptions still occur infrequently on Cameroons Mountain and Fernando Po, sometimes simultaneously in the two places. Springs bubbling with carbon dioxide are found in Fernando Po, and sulphur springs are said to occur in S. Tomé. All the evidence tends to show that the three islands never had any land connections either with each other or with the continent. . . . [Julio] Henriques . . . (1917) evidently held a contrary opinion, considering the islands to represent peaks of a submerged part of the continent . . ."

My plans for more trips in this region suddenly came to grief. The day after I moved my permanent camp into Macambrará, having done a good deal of collecting during the day, I sat by the evening lamp reading *Don Quixote*, not knowing that something practically out of that book would happen this same night.



The author collects insects in a little valley near Nova Celyão plantation, São Tomé.

About midnight I was wakened by voices outside. Out I went, and there stood a messenger, trying to explain something to me. I didn't understand him at all and sent him down to Senhor Battista with a note inquiring what was up. Somehow I had an uneasy feeling that the devil was playing with my plans.

At 3 A.M. another knock—this time Senhor Battista himself plus a Portuguese police sergeant and a native policeman. The cop had a note typewritten on a scrap of paper in red ink to the effect that "Per ordem de governadore" . . . etc., etc., one "Canadienne Boris" (!!!) . . . was to report forthwith to the police station, baggage, papers, and all, transportation being provided, etc. I knew the steamship *Angola* was in port that same day, Monday morning, and would sail for Luanda, in Angola. I got the idea pretty well without further explanation.

We walked down in total darkness to Zampalma, which took over an hour. All this time the two policemen followed less than a yard behind me whichever way I turned, lest I should jump the procession. They took no chances, but just where they thought I could jump was a mystery to me, who didn't know the terrain—and with the trail narrow and winding along the

edge of a thousand-foot precipice treacherously hidden by the matted vegetation along its edge.

It was 7 A.M. before we made it to the police station, where a lieutenant met us waving his hands and crying "Bateau, bateau!" He assumed I could understand French. This is all I did understand—it was plain enough: they wanted me to leave immediately.

I tried to find out the cause of this sudden action, but it was no use. Permission for my stay on the island was revoked, or never did arrive, although originally I was granted 60 days. I protested, not knowing what the Academy's reaction would be to a trip to Angola since nothing of the sort had ever been planned; moreover, part of my baggage was left in Douala in the French Cameroons. Ultimately the cops softened up to the extent that they agreed to let me wait over a few days for a Spanish ship to Douala via Fernando Po. From their attitude, however, I clearly understood that I would have to do the waiting in the local clink. Exploration of Portuguese jails, especially on São Tomé, did not appeal to me and was definitely not in my plans—after all, I'd found no new species of insects in the Tipasa jail in Algeria. I settled for Angola. It was with reluctance, even so, but I knew there was an American Consulate in Luanda where I could complain.

This being deportation, there was, of course, also the question of passage. "Who will pay the passage?" I meekly inquired.

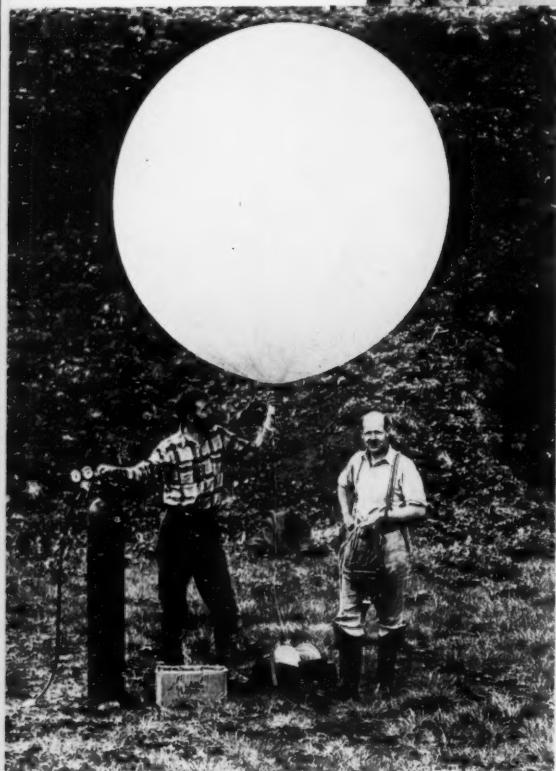
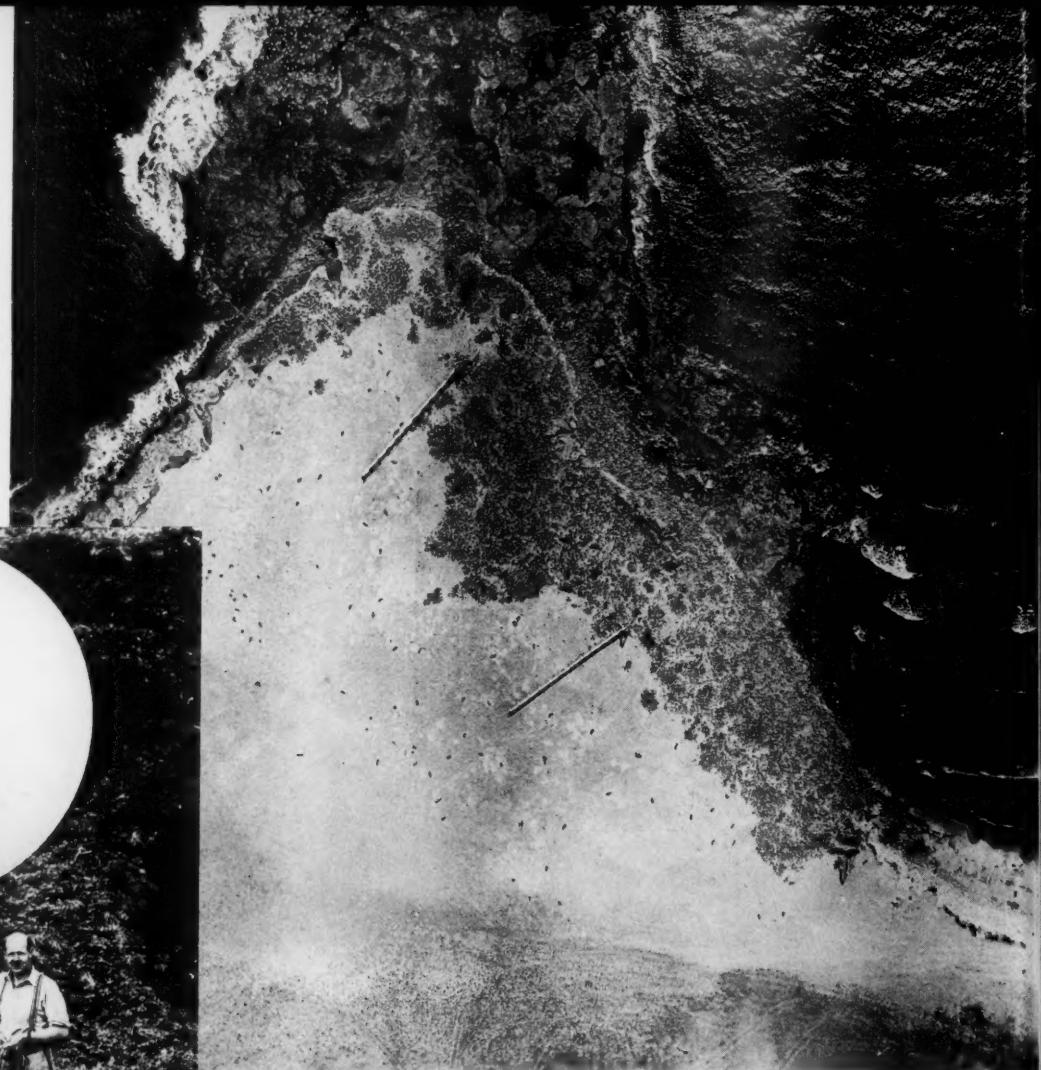
"You or the company," the police officer replied. I finally gave up and paid the passage. There were a few more formalities which took a couple of hours—having the passport stamped by the chief judge who was also, as it turned out, the chief of the local police, who also had to stamp the passport!—then I was off in the motor boat to the *Angola*.

There was one more surprise in store—company for my misery. Aboard the *Angola* were the five young Englishmen who made up the above-mentioned Oxford University zoölogical expedition to São Tomé. They had not even been allowed to land, in spite of their having legal visas.\* Perhaps the local authorities suspected some sort of foreign conspiracy to take over the island and regarded us as some sort of advance party, so much more dangerous than one of the conspirators was born in Russia! The Oxonians had no visas for Angola—I had mine just in case—and were proceeding more or less into the unknown. And so we all sailed off for Angola, to explore that Portuguese colony none of us had ever intended to set foot upon.

END

\*Later, difficulties were straightened out and the Oxford boys spent a few weeks on São Tomé, collecting and taking photographs. As for myself, I ultimately had the moral satisfaction of learning that my own summary treatment had been an official blunder. But how I wish I had taken more pictures while I was there!

► Aerial photographs help the biologists estimate fur seal populations. In this view of Polovina rookery, each fur seal harem shows up as a rosette-like object. Below (inland) are the scattered "idle bulls" without families. Two elevated walkways stand out sharply—from them the biologists can watch the seals without risk.



◀ A camera goes aloft under a captive balloon to photograph seal beaches. Robert W. Dickerman (left) from Cornell University and Dr. G. C. L. Bertram from Cambridge University helped out with the biological studies on the Pribilof Islands in 1949.

► Another method of estimating the fur seal population is counting the pups on the ground and correlating the figures with known breeding habits of the seals. The pups themselves are carefully studied and their growth charted. They gain about 20 pounds on a diet of mother's milk, spend most of their time sleeping, nursing, and scratching.



VICTOR B. SCHEFFER

# Probing the Life Secrets of the ALASKA FUR SEAL

Photographs by the Author

TEN YEARS AFTER THE AMERICAN REVOLUTION a Russian fur-seeker sailed from the Aleutian Islands on a northward course into the Bering Sea. Gerasim Pribilof was his name. He moved on uncharted waters, following the Alaska fur seals which, by the legions, were swimming northward in early summer, headed through the fog for a destination as yet unknown to man. He succeeded in finding the little group of islands that now perpetuate his name. To most of you, the Pribilos are better known as the Fur Seal Islands, a group of treeless, volcanic rocks where, each summer, a million fur seals lift their sleek gray bodies out of the ocean and climb on land to bear their young, to mate, and to rest.

The Russian was lured into the unknown in 1786 by the prospect of wealth. Today, Government naturalists of the Fish and Wildlife Service are following his track in the Bering Sea, also with discovery as a goal, but the discovery of scientific facts, not material riches. Each summer these men go north to explore the biological mysteries of the

fur seal herd. Often in company of visiting scientists from other nations, they spend the summer in studying the anatomy and behavior of the fur seal with a view to increasing the revenue which the Government enjoys from the sale of seal skins. This revenue amounts annually to three or four million dollars, depending in part on the vagaries of feminine fashion. As a partner in the business, Canada forbids her citizens to hunt seals during the winter and spring along the British Columbia coast. In compensation, she receives one-fifth of the Pribilof harvest of skins.

The staff engaged in management research now includes Karl W. Kenyon, Ford Wilke, and the writer. In 1949, Dr. G. C. L. Bertram, of England, was a summer companion. In 1948, the Canadian scientists, Drs. G. Clifford Carl and Georges Préfontaine, took part in the biological program; and in 1947, Sr. Raul Vaz-Ferreira, of Uruguay.

I should like to tell you about the fascinating research problems that confront the fur seal biologists and how these problems are being met.

*All the counting, measuring, observing, and laboratory work have one chief object—the maintenance of the fur seal herd as a natural resource. Here, Scaler John Hanson takes the length of a freshly killed seal. Over a million seals have thus been measured as a precaution against over-killing of the male breeding stock.*





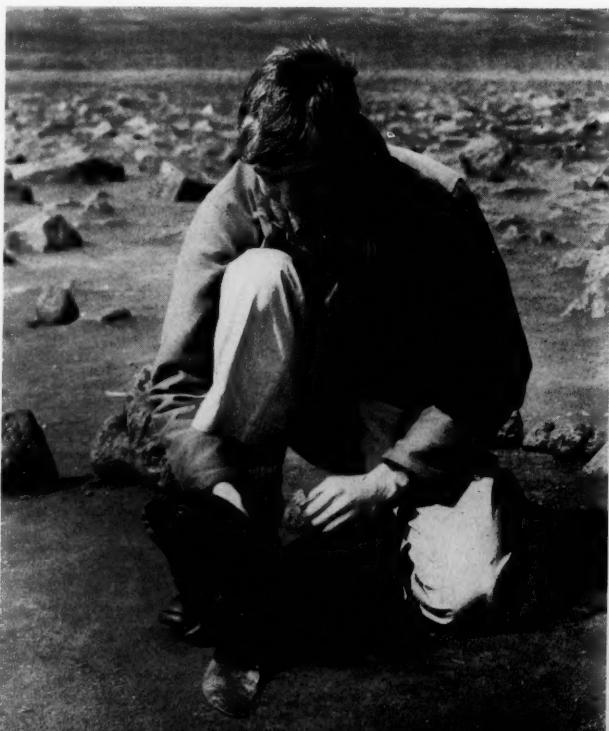
▲ A million fur seals gather on the Pribilofs each summer, give birth to a half million pups—here gaining strength for their first trip to sea, a trip only half will survive.

From the start, we have been handicapped by a meager library of information. We can not, for example, turn to reports on fur seals by European zoologists for the simple reason that there are no fur seals or other eared seals in the North Atlantic. On the American mainland, information has been steadily accumulating on game and furbearing animals like the elk, deer, rabbit, and muskrat. On the remote Pribilof Islands, however, relatively little effort has been spent on basic life-history investigations of the fur seal—certainly little in proportion to the value of the herd.

► The fur seal pup is precocious. At birth he weighs about 11 pounds, has many of his permanent teeth, eyes wide open, voice well developed—all ready to stand the rough life of an Arctic explorer. The biologist is Dave Wiltsie, University of California.

Important contributions have been made by Californians. The Commission of 1896-1897, led by Dr. David Starr Jordan, president of Stanford University, was instrumental in saving the seal herd from extermination. You may be familiar with the four-volume set of books, *The Fur Seals and Fur-Seal Islands of the North Pacific Ocean*, published in 1898 as a climax to the work of this commission. Dr. G. Dallas Hanna, now of the California Academy of Sciences, spent the years from 1913 to 1920 on the Pribilofs and assisted in the formulation of the present management policy.

If any one mystery of the seal herd could be called "chronic" it is the question of population size. Yearly the general manager inquires, "How many seals of each age and sex do we have?" At one time, before international protection brought prosperity to the herd, the population fell off to a low of 125 to 150 thousand. Between 1911 and some date in the late thirties the herd grew to over a million. It has now reached its ceiling under the present system of management. That is, the birth rate is in effectual balance with natural and artificial losses. Thirty years ago the seal herd was small enough so that its members could "stand up and be counted" by men walking along the beaches, tallying the number of breeding males and newborn young. (Since each mother seal is to bear a single young at a time, the number of breeding females can thus be easily calculated.) Given these important values, the number of breeding adults and the number of offspring, it was not too difficult for the biologists of the 1920's to estimate closely the size and makeup of the



entire herd. Now, however, with over a million animals on land in midsummer, the problem of taking inventory is a challenge to the ingenuity of the biologist. Karl Kenyon has recently prepared a population estimate based on aerial photographs, land counts of newborn pups, land counts of bulls, and the growth-curve of the harvest over a period of years. From three different approaches, his answer comes out to about one and one-half million animals at the close of the pupping season.

A new inventory is under way. In the sealing season of 1950 the biologists found out approximately how many pups were born in 1947 (half a million), but have not yet completed calculations which will lead to a more exact figure. In 1947 we placed stainless metal tags on the left fore-flippers of twenty thousand seal pups and also punched a quarter-inch hole in the leathery web of each left hind-flipper of each pup. Now the marked animals are of "killable" age, namely, three years. We have examined 60,000 carcasses of the season just past and have ascertained the percentage carrying tags or tag scars. On the basis of the results, we are calculating the number of pups born three years ago.

The need to understand the mortality factors at work in the seal herd has become increasingly urgent as these factors have built up to the level where they balance the birth rate. While the seals are remarkably free of disease, as compared with land animals, and may live to an age of twenty years, they are vulnerable to a parasite which kills 10 to 20 per cent of the newborn pups. The hookworm (*Uncinaria lucasi*), a needle-sharp or-



▲ Biologists weigh a marked 9-year-old bull. When branded in 1940 he weighed 10 pounds; when collected as a specimen, 415 pounds. Research on the fur seal islands is not for the white-coated biologist with tweezers!



▲ Counting pups is a difficult but important job. The little animals are streaming away towards the background, "running the gauntlet" between two enumerators.

◀ On the ladder is General Manager Clarence L. Olson in the midst of a 10-day inventory of bulls. This arduous task is completed in the last two weeks of July.





◀ On June 23 the bulls were spread out like checkers on a board waiting the arrival of females. Biologists would like to know why 20-25 per cent of them seem unable to capture or hold any females.

▼ A bull in prime condition challenges the photographer, with a more than three-to-one weight advantage!



ganism, drills into the intestinal wall of the nursing and produces anemia. The United States Bureau of Animal Industry is collaborating with us in an attempt to solve the problem. How and where do the worms live through the winter? Why do certain pups die while their companions recover? What can be done to reduce mortality? One of our sad experiences on the Pribilofs was to walk along the beach at Northeast Point in August of 1948 and count 21,600 carcasses of nursing pups, nearly all of them victims of the deadly hookworm. There are parasites of lesser importance, including stomach worms, tapeworms, thorny-headed worms, lice, and mites. The only known predator of the seal is the killer whale (*Grampus rectipinnis*).

Severe weather takes a toll of the young seals, especially the little pups at sea in their first winter. During the cold February of 1950, the starved bodies of over 700 pups washed up on the beaches of California, Oregon, and Washington. A general alarm was sounded by residents along the beaches, and the United States Coast Guard took part in a search for the source of the trouble. In a PBY "flying boat," Kenyon and I traveled from Port Angeles, Washington, to the California border and back on a bright, sunny day. Skimming along at an elevation of 200 feet we counted fur seals on the ocean beneath us. When we later had an opportunity to examine several dozen little corpses, we found that they were starved. The combination of bitter winds and high seas had apparently kept them from feeding. An unsolved mystery was the appearance of thirteen fur seal

carcasses on the shore of Caton Island, Alaska, in the summer of 1934. And in 1941, forty appeared on the same beach. Were they victims of a submarine fumarole? of paralytic shellfish poisoning? of a lightning stroke? We don't know.

The reproductive rate of the fur seal is an important statistic, as any stockman will agree. The biologists spend a good deal of time studying the genital anatomy and breeding behavior of the seals. The animals haul out on the Pribilofs to breed and rear their young, and virtually all of their activities on land are associated, in one way or another, with these functions. Microscopic study of the gonads of seals of known age, that is,

*A fur seal family:  
mother, pup, and  
proud father.*



tagged animals, has revealed that the females are capable of breeding at age two and the males at age three or four.

Slow progress has been made in understanding the quantitative aspects of seal reproduction. Thus, we know but imperfectly what percentage of two-year-old females actually breed; what percentage of adult females skip a pregnancy now and then; and so on. In the fall of 1949, the results of an experimental kill of one hundred female seals on the breeding grounds enabled the biologists to estimate that one out of five adult females fails to give birth each year. This information can now be used in computing the rate of recruitment in the seal herd. Biologist Kenyon spent the early spring of 1950 at Sitka, Alaska, collecting 41 fur seal carcasses from the Indians who speared the

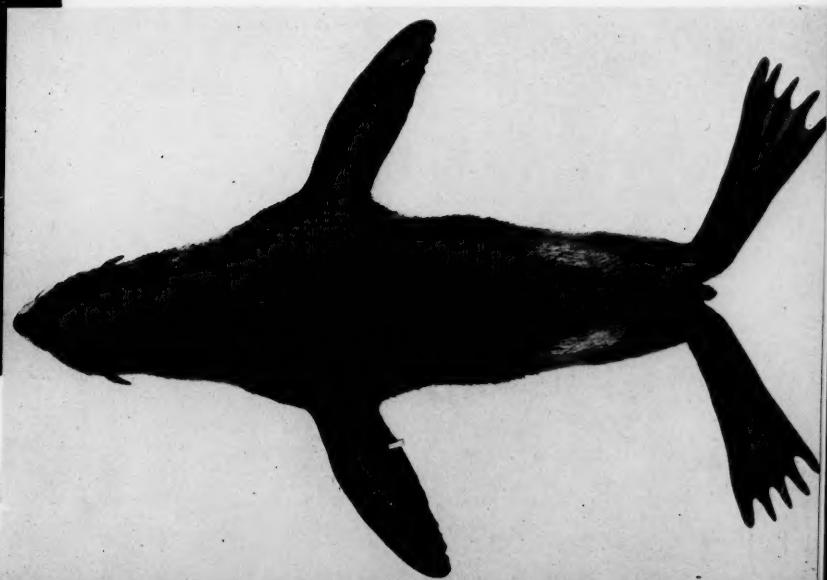
animals at sea. (The aborigines of the American coast still enjoy the privilege of sealing, as their forefathers did.) From the carcasses, we obtained confirmatory evidence that one-fifth or more of the adult females do not breed each year.

More is *unknown* than *known* about the breeding life of the seal. How, for example, is the bull seal able to go for two months without food or drink? One of our summer helpers, Lavrenty Stepetin, kept a daily watch over several bulls and found that one remained on his post for 59 days, another 54 days, before calling it quits. And these individuals had been on the job when Lavrenty first started to watch them! Is twinning a possibility in the seal or is it precluded by the curious arrangement of the uterus, one side of which functions this year and the other the next? Dr. Robert

◀ *One in 100,000 seals, the albino has no protective pigment in the iris of the eye and squints in strong sunlight. Kipling's White Seal of Jungle Book fame was a freak of this kind. You can see an albino fur seal in the San Diego Zoo.*



► *Recovery of tagged individuals enables biologists to study growth rate and migration pattern of fur seals. This one was tagged as a pup on the left fore-flipper, collected as a specimen one year later.*





▲ "Blood, sweat, and tears"—employees of the Fouke Fur Company of St. Louis, Missouri, spend the sealing season on the Pribilofs. Here they remove the thick layer of white fat from 60-70,000 seal skins. One hundred skins is a good day's work for one man.

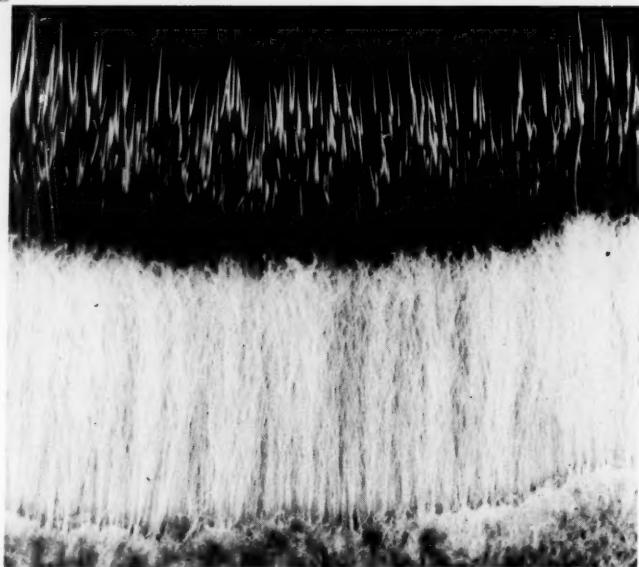
► Cross-section of fur seal pelt (magnified x4) showing the three layers: skin (below); fur (middle), composed of soft, curly fibers; hair (above), composed of stiff, coarse, bicolored fibers. In its processing plant, the Fouke Fur Company removes the hair, straightens and dyes the fur, and thins the skin.

▼ Terenty Philemenoff ties a string through the armhole of a fur seal pelt set aside for experimental use. Terenty, like some 500 other Pribilof-born employees of the Government, speaks Aleut as well as English.



K. Enders, of Swarthmore College, has recently discovered that the tiny embryo, or blastocyst, remains quiescent and microscopic in size for the first four months or so of life, whereupon it renews its growth and appears in the following summer as a ten-pound pup. What mysterious body secretion, or lack thereof, arrests the growth of the fetus? We believe that investigations into the reproductive anatomy of the seal may help to improve the management of the herd. For example, we may be able to develop a method of weeding out sterile and over-age females to the benefit of the herd and to the profit of the Government.

Some time ago a young lady wrote to our office, as follows: "I am writing a thesis entitled 'Sex Choice and Tone Color' . . . I will appreciate it if you can give me information on the vocal or mu-



sical expressions of fur seals." While we dutifully answered her letter we have always felt that we were inadequate to the subject. We remain somewhat puzzled.

The *fur* of the fur seal is naturally an appropriate subject for study. The Government's operator or concessionnaire, the Fouke Fur Company of St. Louis, Missouri, has invested hundreds of thousands of dollars in technological studies of the fur seal pelage. This company is responsible for the curing, processing, and sale of the skins. The best kind of seal to be killed is decided upon from time to time in conference. That is, the company

*The author tags specimens in the laboratory on St. Paul Island where fur seals are weighed, measured, and dissected.*



considers such characteristics as ease of processing and ultimate market value, while the Government considers ease of killing and the effect on the welfare of the herd. The seal now in vogue as the "killable" is the 3-year male.

On the Pribilof Islands, the biologists sample the harvest from time to time in order to learn how closely the killings are following a set pattern. We estimate the age spectrum of a sample killing by taking certain measurements of each seal, as follows: length of body, length of baculum (penis bone), weight of skin, and size of right upper canine tooth. We have recently discovered that the teeth of the seal have ridges, usually one for each year of growth, which furnish a clue to age.

Through study of the habits of fur seals in captivity we are able to pick up bits of information that would otherwise be hard to obtain. Our good

friend, Mrs. Belle J. Benchley, of the Balboa Park Zoo in San Diego, is successfully holding in captivity a number of fur seals. These seem out of place in a freshwater pool festooned with tropical vines, but they thrive in their foster home. We asked Mrs. Benchley to feed colored food to one of her seals so that we could find out the rate of passage through the alimentary tract but, so far, the "guinea pig" has refused to coöperate in the experiment.

The biologists are more interested in understanding the normal pattern of life on the fur seal islands than they are in collecting and studying the freaks that pop up occasionally in the seal herd. In this category we find the albino, the congenital cripple, the cryptorchid, the seal with seaweed or barnacles on its back, the hairless premature pup, and so on. During the war years, no

*"The Pribilos are nearly as 'aquatic' as they can be and still be called land. They suit the amphibious seals, and where the seals go we're willing to follow."*



## REVIEWS

GRAY'S MANUAL OF BOTANY: *A Handbook of the Flowering Plants and Ferns of the Central and Northeastern United States and Adjacent Canada*, Eighth (Centennial) Edition—Illustrated. Largely rewritten and expanded by Merritt Lyndon Fernald. American Book Company, New York. 1950. lxiv + 1632 pp., line drawings. \$9.50.

For an Eastern or Middle Western botanist, the owning of this eighth edition of *Gray's Manual* is, indeed, a must. Forty-two years have passed since the first

appearance of the seventh edition of this important taxonomic work, and during this interval some three thousand additional species, varieties, and forms have been described in the area encompassed by the book. Modern taxonomy has seen other recent fundamental changes as well, such as the establishment of the International Rules of Botanical Nomenclature and an increased understanding of the flora through extensive field work in the last half century. It follows that the revision of the old edition was a virtual necessity.

fewer than ten little bachelor seals turned up with peculiar rubber collars around their necks. The mystery was solved when Army officials brought out from their museum rubber food-bags, captured from the Japanese at Attu, which matched the collars. Your guess is as good as anyone's as to how the seals got into their collars. In a million animals under close surveillance the opportunities for seeing freaks are rather good, and we confess that we probably give them more attention than they deserve. On the other hand, an abnormal individual may occasionally lead to a new discovery.

In their spare moments the biologists, impelled by curiosity, probe into the anatomy and behavior of fur seals to obtain information which has little or no value to management at the present time. We simply want to know everything that it is possible to know about fur seals. We have found, for example, that the body temperature of the seal is the same as man's, 100° F. (internal), and that seal blood clots very rapidly, in less than five seconds. The newborn seal can (but doesn't like to) swim for 15 or 20 minutes without assistance. The adult seal can dive to a depth of at least 240 feet and swim at the rate of 15 knots.

We usually spend a little time each summer studying the waste materials or byproducts of the fur seal industry. Meal and oil valued at \$50,000 a year are recovered from seal carcasses. While the salvaging of the carcasses is not especially profitable, you will readily understand the importance of cleaning up the killing fields as a sanitary measure. A study of vitamin A in seal liver has shown that the average liver is worth only 25 cents, although some are worth as much as \$4.25. Thus, the recovery of vitamin A would hardly be economical. Tests of seal flippers for glue and gelatin content place them in an unfavorable light in comparison to the usual sources: cattle, sheep, and hogs.

The University of Washington College of Fisheries is exploring a promising lead. They find that seal meal in the diet of hatchery fish is a stimulus to growth. When you consider the importance in Washington of the hatchery business, an industry that uses over 3 million pounds of fish food annually, you can appreciate the potential value of fur seal meal as a diet supplement.

We have dwelt on a number of research problems that are related to the annual revenue from the seal herd. We should like to mention one that is related to the national status of the herd. "In their food habits" you may ask "do the seals compete to an important extent with commercial fishermen along the American coast?" With regard to this question we believe that the evidence from some 1,300 seal stomachs points to a harmless diet. Although the herd may eat 750,000 tons of food a year, the main species consumed are squid, pollock, and herring, all relatively unimportant in the economy of the American people at present. (We foresee, though, a time, perhaps many years hence, when our crowded citizenry will place a higher value on sea foods and a lower value on seal skins. At such time, a reduction in the size of the herd will be in order.)

The life of a biologist on the fur seal islands is a fascinating one. We love it. True, it has its disadvantages. The weather during the summer months when the seals are available for study is certain to be cool, damp, and cloudy, with temperatures hovering between 40 and 50 degrees. You photographers will know what it means to contend with dull lighting and salt spray or volcanic sand blowing across your lens. We console ourselves with the thought, though, that were the climate like sunny California, our subjects, the fur seals, would not be here. The Pribilofs are nearly as "aquatic" as they can be and still be called land. They suit the amphibious seals, and where the seals go we're willing to follow.

END

This new edition prepared by M. L. Fernald of the Harvard Gray Herbarium appears just a century after the first publication of *Gray's Manual* in 1848. Though the primary edition was one of many nineteenth century taxonomic surveys of the Northeastern and Central States flora, it was the only one of these to have been periodically brought up to date. Asa Gray himself prepared the first five editions of the text, and since his time other Eastern workers in the field have shouldered the task. With its unique history the book has stood as a milestone among American botanical handbooks in the last century.

The previous editions have gradually increased the area covered by the book until the current work, once more extending the "Manual-range," includes a segment of the South Coastal Plain flora in the state of Virginia. This extension has raised some objections, since it adds a great many South Coastal Plain species whose ranges are chiefly outside the topographic scope of the book. A further extension of the *Manual*-range is made in the new edition in southern Canada to include Newfoundland, the Gaspé Peninsula of Quebec, and the Magdalen Islands — an addition seemingly more justified since it encompasses a northern fringe area which is allied to the flora of the Appalachians and Northern States.

One of the chief modifications over the old editions is a marked improvement in the structure and arrangement of the taxonomic keys. Mr. Fernald has put the old multiple-choice key system on a strictly dichotomous basis, and employed a clear paragraph organization, facilitating the use of the book. The addition of many morphological characters to each key entry, as opposed to the old "single-character" system, comes as another welcomed improvement. The taxonomic treatment includes a useful, newly elaborated Synoptic Key to Orders and Families as well as the revised Artificial Analytical Key to Families, and has wrought many changes in nomenclature and spelling of Latin names, some according to recent botanical publications, and some newly introduced by the author of this edition. Certain typographical errors which appear both in the index and in the body of the book perhaps will be eliminated in a second printing.

Another new feature of the eighth edition is the creation of two indexes, one for Latin nomenclature, the other for colloquial English and French-Canadian names which serves to simplify the process of reference-hunting in so expansive a volume.

While the new *Manual* is still designed primarily for the use of professional plant taxonomists, this revised publication, as opposed to the old editions, will undoubtedly prove more useful to the amateur student of botany.

ESTELLA B. LEOPOLD

Department of Botany  
University of California  
Berkeley

FOREST INFLUENCES. By Joseph Kittredge. McGraw-Hill Book Co., Inc., New York. 1948. x + 394 pp., illustrated. \$4.50.

Subtitled "The effects of woody vegetation on climate, water, and soil, with applications to the conservation of water and the control of floods and erosion," this textbook supplies a needed quantitative treatment of the basic ecological factors encountered in the forest. Since the author is professor of forestry at Berkeley, the treatment is particularly applicable to the Pacific Slope, and the practical aspects of such phases of applied ecology as erosion control and watershed maintenance receive detailed attention.

JOEL W. HEDGPETH

Department of Zoölogy  
University of California  
Berkeley

POCKET ENCYCLOPEDIA OF ATOMIC ENERGY. Edited by Frank Gaynor. Philosophical Library, New York. 1950. 204 pp., charts and diagrams. \$7.50.

The "scholar, researcher, teacher, librarian, student and intelligent layman" who acquires this book to



Tallest of all  
trees—many are 350  
feet high—some  
are 2,000 years old.

## SAVE THE REDWOODS

Send 10 cents each for these attractively illustrated pamphlets: "A Living Link in History," by John C. Merriam . . . "Trees, Shrubs and Flowers of the Redwood Region," by Willis L. Jepson . . . "The Story Told by a Fallen Redwood," by Emanuel Fritz . . . "Redwoods of the Past," by Ralph W. Chaney. All four pamphlets free to new members—send \$2 for annual membership (or \$10 for contributing membership).

SAVE-THE-REDWOODS LEAGUE  
250 Administration Building  
University of California, Berkeley 4, Calif.

stand beside his Webster and his Rand McNally, will learn at once from the Preface that "atomic" energy and "atomic" bomb should be nuclear energy and nuclear energy bomb. It is admitted that the "scientifically meaningless and, even worse, misleading" expression has become so set in popular usage "that even scientific authors are compelled" to use it when addressing the public. The miscalled "Atomic Age" was thrust upon us so suddenly, we laymen were caught without the most rudimentary working vocabulary. Such a book gives us that and, in the using, the first-grade elements, at least, of the awesome new science that is at the core of our greatest hopes and our worst fears.

D.G.K.

---

**HIGH JUNGLE.** By William Beebe. Duell, Sloan and Pearce, New York. 1949. xii + 379 pp., 48 photographs, map. \$4.50.

"Hummingbirds of the Mist," lead article of *PD's* first issue, and "Private Lives of Jungle Falcons," with which our March-April 1949 issue began, appear in context in Dr. Beebe's twenty-second book. The other twenty-two chapters of *High Jungle* are also in the best Beebe tradition, which means for so many of us the best in this kind of book. Everyone who has read most or all of his popular titles will recognize with de-

light the familiar Beebeisms: example, the trip down from New York.

A trip with William Beebe, as his readers and the lucky few who've watched with him at the rail for flying fish or the first drifting sargassum weed know, is adventure of the first water. But the great fact you get from both first-hand and second-hand experience is that the trip, sea or air, to an edge of the jungle or a Nonsuch, for this old hand at exploring the world's far ends, himself, is still and always a keenly felt, enjoyed, instructive part of a season in the field. Though it takes four chapters to get to fantastic Rancho Grande, field station in the "high jungle" of Venezuela's Andes, you are not impatient when the naturalist pauses to explore a "Caracas Garden"; he thus leads you gently to the big thing, the limitless continental forest.

Rancho Grande, multi-storyed maze of concrete the dictator Gómez didn't live to finish, takes many fascinating pages. Laboratory, hotel, observatory for the great bird- and insect-flyway of Portachuelo Pass, it was also a ready-made live-trap for everything from ferdelance to peripatus. But for distilled and rectified essence of biological observation, top-fraction Beebe, my choices are "Ants and Ants," "Parade of the Maggots," "Palisade Magic." Perfect close is the return home in spirit with migrating blackpoll warblers. Jocelyn Crane's photography is splendid.

D.G.K.

---

#### FROM THE READER (*Continued from page 5*)

whole body politic, e.g., one outlawing membership in the Communist Party, its effect with respect to teachers would raise no sound issue of academic freedom in either a legal or a philosophical sense. This suggests that the simple test for academic freedom as stated by Dr. Miller: Does the scholar have the right "to call his shots as he sees them?" may have to be complemented. Such a test is of clear significance and worth as an ideal. For my own part, I should prefer no qualification beyond this: A proper correlation of the law of the land will be necessary if that ideal is to become wholly practical.

FRANCIS C. HUTCHENS

San Francisco, 13 July 1950.

EDITOR, *Pacific Discovery*

SIR:

The purpose of these lines is . . . to commend [Dr. Miller's] very excellent editorial . . . What you write in defense of academic freedom may well be extended in defense and need of all freedom. Our great republic was founded as a rational organism in an age of awakening reason; at times it would appear as though the world were moving farther and farther away from rationalism and embracing irrationalism if not anti-rationalism. In that direction lies Fascism. And Fascism is but the Scylla or opposite and counterpart of that other monster, Charybdis or Communism. Between these two perils lies the narrow path of human understanding, that of the Golden Mean.

HERBERT HAAS

Oakland, 1 August 1950.

#### The Tioga Road

EDITOR, *Pacific Discovery*

SIR:

I have found *PD* particularly intriguing. Perhaps Dr. Bradley's article on the Tioga Road [Harold C. Bradley, "Yosemite's Problem Road," *PD*, Jan.-Feb. 1950] impressed me most. As soon as I learned that the Yosemite Transportation System operated a bus over the road from Yosemite to Lake Tahoe, I incorporated the trip in my vacation plans . . . I found it an extremely interesting and thrilling one. The views of rugged peaks like the Cathedral Peaks and Unicorn, of Lake Tenaya and other lakes, and of the uplands like Porcupine Flat and Tuolumne Meadows made it memorable. For what it might be worth, I may say that my trip left me with a leaning toward Dr. Bradley's third proposal—the two one-way roads.

EDWARD W. DALTON

Puente, California, 9 August 1950.

#### Night Saving Time

EDITOR, *Pacific Discovery*

SIR:

Just a note to say how very much I enjoyed the last number. That editorial by Dr. Miller is a masterpiece and I had a lot of fun reading it to a 4-H Senior group at campfire at Whitaker's Forest. They got a lot of enjoyment out of it, too.

WOODBRIDGE METCALF  
Extension Forester

Berkeley, 5 September, 1950.

#### PACIFIC DISCOVERY

This bank is proud to present, as a constructive  
contribution to the entire community

AN EXCEPTIONAL SERIES OF

## *Television Programs*

CREATED BY THE

# *California Academy of Sciences*

"SCIENCE IN ACTION"

Thursdays, 7 to 7:30 p. m., beginning September 21

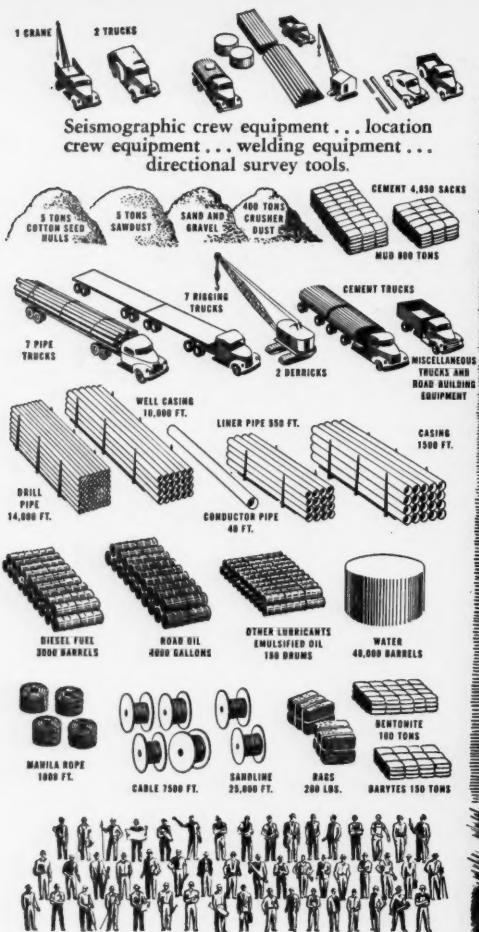
KGO-TV

A descriptive booklet, outlining the programs by dates, is  
available at American Trust Company offices. Your  
comments are cordially invited.

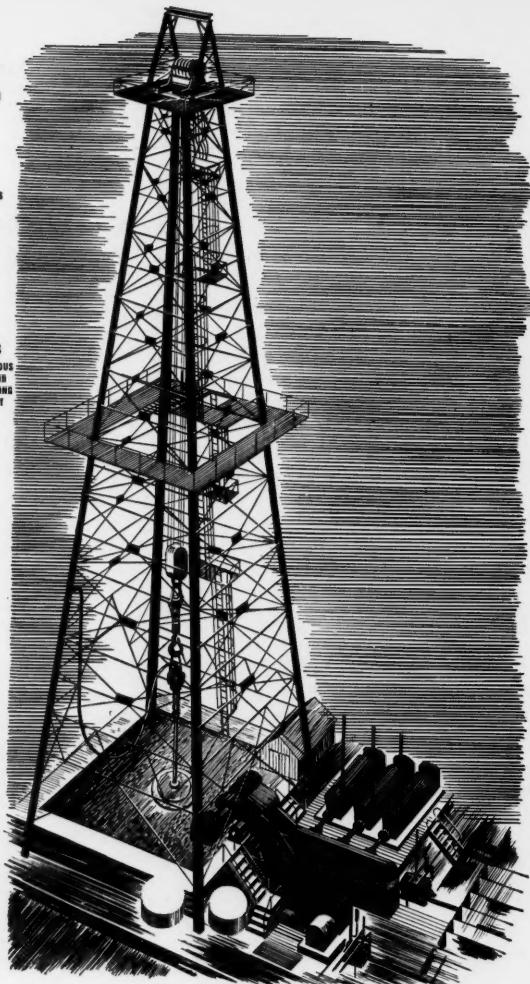
*Many Offices Serving  
Northern California*

*Member Federal Deposit  
Insurance Corporation*

AMERICAN  
TRUST  
COMPANY  
BANKING  
*Since 1854*



One hundred and thirty two men who are experts in many fields—law, geology, engineering, drilling, trucking, carpentry, derrick building, chemistry, mechanics and so forth.



One completed oil derrick with all its diesel engines, bits, fishing tools, reamers and other equipment.

## Want to drill an oil well? Here's all you need

There *may* be oil under your backyard . . . but you might as well face the fact that it will take a bit of doing to find out.

The picture above shows all the men and materials needed to drill one 10,000-foot exploratory well here in the United States. Total cost will be anywhere from \$125,000 to \$1,000,000 depending on conditions encountered.

Will oil be found? Even with the best scientific help only about one out of every five exploratory wells drilled "come in."

The search for oil is a risky, expensive business, but it goes on every day in many parts of the world. In 1949 alone, we drilled 28 exploratory wells at a cost of \$6,385,000 . . . six striking oil.

A great share of the profits of Standard of California goes back into the business in exploration of this kind . . . and in building

new refineries, new pipelines, new storage plants and other facilities. From these come good petroleum products to serve you well . . . petroleum products to add still more strength to our nation in the uncertain days ahead.



